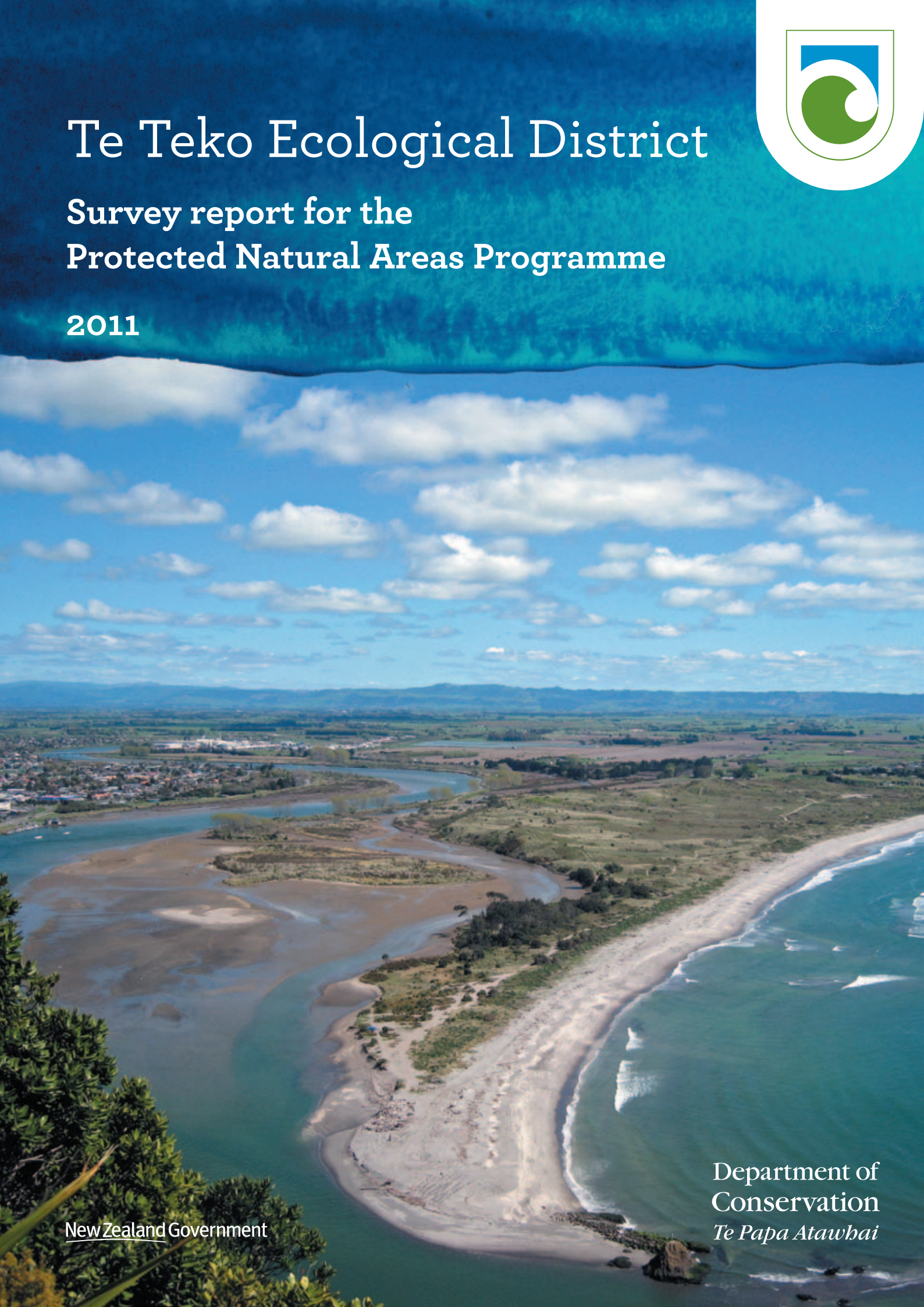
Te Teko Ecological District

Survey report for the Protected Natural Areas Programme

2011



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Te Papa Atawhai

Te Teko Ecological District

Survey report for the Protected Natural Areas Programme

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2011

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Cover: View of Whakatane Estuary and Rangitaiki Plains from Kohi Point. Photo: Sarah Beadel.

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Foreword

This report forms part of the Protected Natural Areas (PNA) Programme series of reports. These reports describe Recommended Areas for Protection (RAPs) within ecological regions and districts throughout New Zealand.

Te Teko Ecological District, in the central-eastern Bay of Plenty, encompasses the Rangitaiki Plains reaching from Kawerau in the south to the coast from Matata to Whakatane. It includes the lower reaches and mouths of three of the major rivers in the Bay of Plenty—the Tarawera, Rangitaiki and the Whakatane. It is one of the most highly modified ecological districts in the Bay of Plenty with intensive agriculture and horticulture throughout. As a result, most of the indigenous vegetation and wildlife habitat has been removed from what was once an extensive wetland and duneland ecosystem.

What remains of the natural areas have been heavily impacted by pest plants and animals, grazing and other human modifications. Wetland ecosystems have also been heavily modified by drainage and stopbanking of the surrounding land which has severely affected the functioning hydrology of these sites. Extensive restoration of some of the natural areas identified in this report is underway and will be ongoing into the future to protect what little remains from further habitat deterioration.

This study enables an objective assessment of the ecological values of the Te Teko Ecological District. It describes the elements of nature that remain, protected and unprotected, and their value as representative examples or special features of our natural heritage. This report provides essential information for landowners, iwi, local authorities, conservation organisations, and for the Department. It will enable us, collectively, to ensure the protection of our natural heritage. This is based on a common understanding of what natural heritage is, where it occurs, and the management necessary to ensure that it is sustained for future generations.

Effective conservation involves partnerships between local and central government, landowners, iwi and local communities. To achieve protection of natural areas the Department of Conservation promotes a wide range of mechanisms to ensure a level of protection which includes covenants, management agreements, protected private land agreements, reserves and District Plan provisions.

The Te Teko Ecological District PNAP report has been prepared by Wildland Consultants Ltd under contract to the Department of Conservation.

Henry Weston
Conservator
East Coast Bay of Plenty Conservancy
Department of Conservation

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Executive summary

Te Teko Ecological District covers *c.* 32,000 ha, comprising the flood plains of the Whakatane, Rangitaiki, and Tarawera Rivers, and a band of coastal sand dunes. Much of the plain was formerly a large wetland, but most of this has been drained with a comprehensive network of drainage canals, drains, water control structures, and pumping stations. Drainage and vegetation clearance has irrevocably altered the ecological character of this ecological district. Remaining natural areas are generally small, and primarily include areas of duneland and freshwater wetland. They comprise *c.* 5.8 percent of the ecological district.

Protected areas cover only *c.* 563 ha, or only 1.9 percent of the ecological district. These include land administered by the Department of Conservation (*c.* 411 ha) and private lands protected with covenants (*c.* 16.2 ha). Fish and Game New Zealand administer 136 ha of wildlife management reserve as game bird habitat. Most protected areas are small, and the largest is only *c.* 130 ha. A further *c.* 1,255 ha (4.9 percent of the ecological district, at 40 sites, has been identified as Recommended Areas for Protection (RAPs). This includes a strip of coastal "reserves" (*c.* 235 ha) administered by Whakatane District Council—these are mainly recreation reserves—which are not formally protected for biodiversity values. Also included is the Whakatane Estuary, and the three major rivers (*c.* 398 ha), which now comprise one of the largest and, in relative terms, the most natural of the remaining indigenous ecosystems and habitats, and also warrant protection as they provide important habitats and migratory pathways for aquatic species.

In spite of the high level of modification, Te Teko Ecological District has retained an important suite of threatened indigenous habitats and species, including sites of national and regional ecological significance: Thornton kānuka (*Kunzea* aff. *ericoides* (d)) forest on the sand dunes between the Tarawera and Rangitaiki Rivers, Tumurau Lagoon, and Matata Wildlife Refuge. Several threatened plant species are present, and two of these—*Cyclosorus interruptus* and *Thelypteris confluens*—occur in several of the wetlands. Significant bird species present include banded rail, white heron, reef heron, marsh crake, spotless crake, Australasian bittern, North Island fernbird, and New Zealand dabchick. Active management is required to retain many of these features in a landscape that is now dominated by human endeavour. It is essential to work closely and collaboratively with landowners to achieve better management and protection of both protected areas and Recommended Areas for Protection, and to achieve the restoration of degraded sites.

1. Introduction

Te Teko Ecological District is in the eastern Bay of Plenty (refer to Figure 1) and has a distinctive flat terrain, extending across the Rangitaiki Plains, a generally mild climate (although cool in winter), and a general lack of indigenous character except along the coastal margin, rivers, and very limited areas of freshwater wetland. The landscapes present include open sea coast, coastal dunelands and estuaries, freshwater wetlands, streams and rivers, and only small remnants of alluvial plain forest.

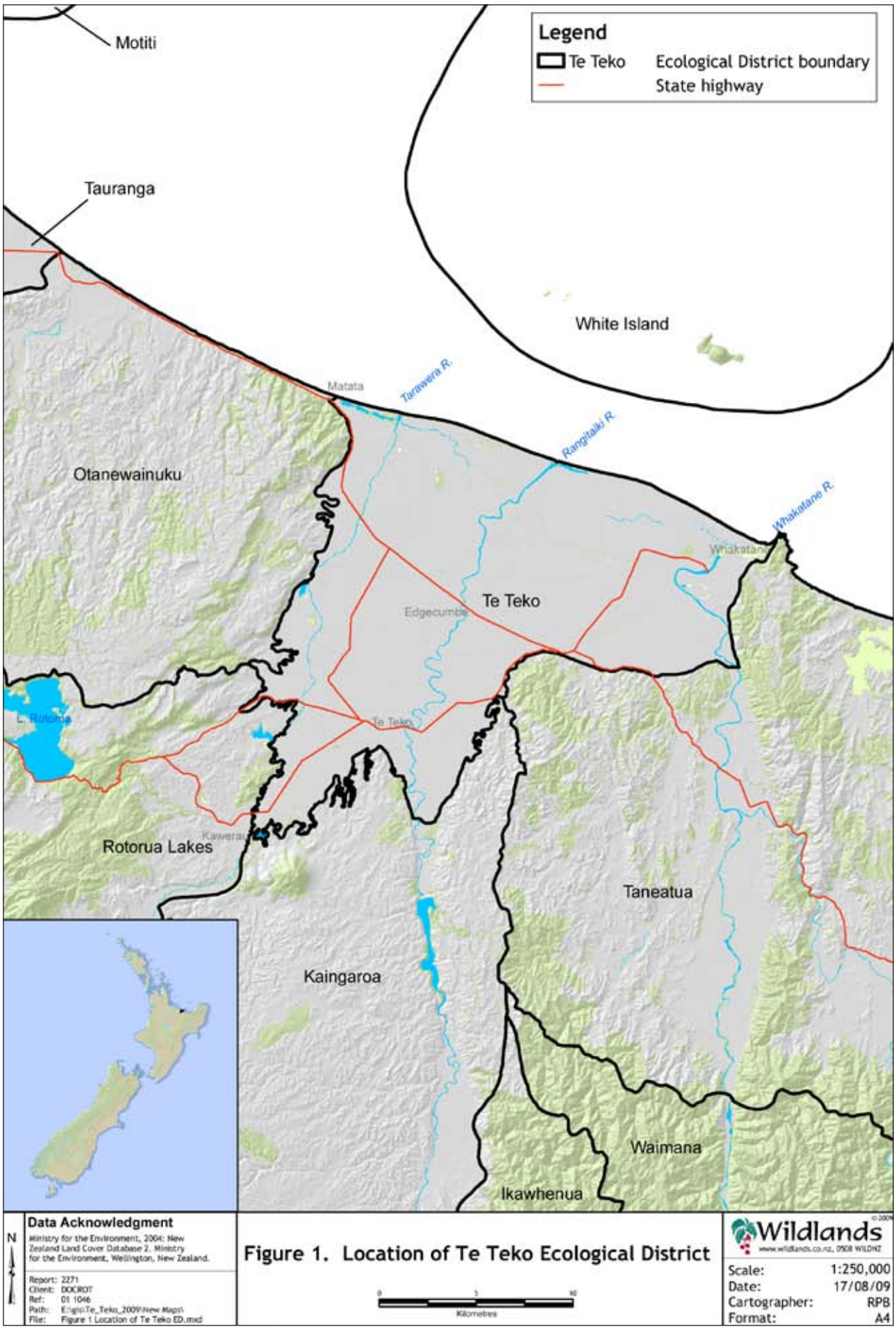
The recognition and recommended protection of representative examples of these ecosystems is a local contribution towards achieving the goal of the Protected Natural Areas Programme (PNAP) nationwide, expressed in the Reserves Act 1977 (Section 3(1)(b)) as follows:

"The preservation of representative samples of all classes of natural ecosystems and landscapes which in the aggregate originally gave New Zealand its own recognisable character."

This study of Te Teko Ecological District was undertaken in 1998 mainly using existing information. Some parts have been revised and updated prior to publication. The following process was used to evaluate remaining natural areas in the district:

1. Existing information was compiled, base maps and aerial photographs were assessed, and sites were identified where field survey was required.
2. Brief field surveys were carried out, and remnants of indigenous vegetation were inspected and described using a standard field survey form.
3. Data was analysed and comparisons made with the features already protected in existing Protected Natural Areas (PNAs).
4. Recommended areas for protection (RAPs) were identified.

Some of the RAPs are highly degraded but are nevertheless important as they often represent the last remaining vestiges of particular natural ecosystems and habitats. There are also sites not identified as RAPs that nevertheless may yet be considered worthy of protection, and some of these have been listed in Appendix 6.


Legend
Te Teko
Ecological District boundary
State highway
Motiti
Tauranga
White Island
Matata
Tarawera R.
Rangitaiki R.
Whakatane R.
Whakatane
Otanewainuku
Te Teko
Edgecumbe
L. Rotoma
Rotorua Lakes
Kaingaroa
Taneatua
Waimana
Ikawhenua
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Ministry for the Environment, 2004: New Zealand Land Cover Database 2. Ministry for the Environment, Wellington, New Zealand.
Report: 2271
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File: Figure 1 Location of Te Teko ED.mxd
Figure 1. Location of Te Teko Ecological District
Kilometres
Wildlands
Scale: 1:250,000
Date: 17/08/09
Cartographer: RPB
Format: A4

2. Ecological character of Te Teko Ecological District

Location and setting

Te Teko Ecological District covers *c.* 32,000 ha and comprises the Rangitaiki Plains, the recent alluvial flood plain of the Whakatane, Rangitaiki, and Tarawera Rivers and extends to the coast, incorporating a narrow band of sand dunes. The plains were formerly a large wetland with limited areas of forest on higher former dune ridges. The former wetlands are now almost completely drained and developed for intensive agriculture and horticulture. The dune system along the coast has been farmed in most places in the past and naturalised species are common, although there are still sizeable areas dominated by indigenous species.

Climate

The climate of Te Teko Ecological District is, for the most part, mild and renowned for long periods of sunshine. The hills to the east and west provide reasonable shelter but cool southerlies periodically sweep down the Tarawera Valley and across the plains. Prevailing wind direction is from south-west to north-west, though north-easterly afternoon sea breezes are common. High wind speeds are rarely recorded in most years.

The coastal zone is among the very sunniest districts in New Zealand, with totals of *c.* 2,300 annual hours of sunshine being recorded in Whakatane (Quayle 1984). Summer temperatures sometimes exceed 30°C. Prolonged summer-autumn droughts occur every few years, with high risk of fires, especially in the coastal zone. This is an important issue for the increased housing development along the coast. Heaviest and most prolonged rainfalls come from northerly storms, with precipitation increasing inland. Mean annual rainfall is *c.* 1,400 mm along the coast, rising to *c.* 2,000 mm over the highest country southward. Ground frosts occur on average 50 days a year, with severity depending on local site factors. Ground fogs occur along the coast on about 20 days a year (New Zealand Meteorological Service 1983b).

Locally severe rain and electrical storms occur every few years. Some of these provide dramatic lightning shows as they sweep across the plains.

Bioclimatic zones

Two bioclimatic zones, as defined by Shaw (1988), can be recognised in this ecological district (see Figure 2):

Coastal

A strip extending approximately 1km inland from the coast, where the vegetation is often exposed to salt-laden winds. Characterised by a range of different plant species depending on the site, but in this ecological district comprising mainly sand dune species (including Thornton kānuka forest) and some saltmarsh species in local habitats.

Semi-Coastal

Most of the ecological district is in this zone, which extends inland from the coastal zone to the inland boundary of the district.

Geology and physiography

Information on the geology of the ecological district and environs is provided by Healy *et al.* (1964). Comprehensive accounts of the comparatively recent origin of a large proportion of the Rangitaiki Plains are given in Pullar and Selby (1971), Pullar *et al.* (1978), Pullar (1985), and Kear (1997).

The plains form the floor of the Whakatane Graben, a major tectonic depression at the northern end of the Taupo Volcanic Zone. Altitude above sea-level is generally no more than 20 m, but does rise to *c.* 40 m in the very south-west. The plains are bounded on the three inland sides by abruptly-rising land: between Whakatane and Awakeri by steep, mainly greywacke, ranges; on the south by the sinuous margin of the Matahina ignimbrite plateau; on the south-west by hilly outskirts of the Rotoiti pumiceous volcanic breccia fan; thence northward by the steep margin of the Kaharoa ignimbrite plateau and an underlying sedimentary rock formation.

The sources of the three rivers crossing the plains lie well beyond it: to the south. Whakatane River rises from far within the greywacke Urewera ranges; the Rangitaiki crosses the Kaingaroa Plateau, with some tributaries from the eastern greywacke ranges, its source some 100 km inland of the Bay of Plenty coast; the Tarawera River drains Lake Tarawera and a considerable portion of the surrounding land. After major pyroclastic eruptions in the Okataina and Taupo Volcanic Centres during the past 8,000 years, these rivers carried vast quantities of volcanic detritus to the ocean on each occasion, for much to be returned as wind-blown sand. This was the main cause of episodic aggradation of the plains, from an approximate line between Awakeri and Otakiri northwards to the present coastline. Frequent flooding and ponding as the rivers meandered across the expanding very low-lying plain, combined with several showers of airborne volcanic ash, resulted in a complex cover pattern of interbedded layers of pumiceous and (in the eastern quarter) greywacke alluvia, and peat and ash. The most important of the volcanic eruptions were the rhyolitic Whakatane Ash, Taupo Pumice, and Kaharoa Ash, approximately 5,200, 1,850, and 900 years ago respectively, and the Tarawera basaltic ash in AD 1886.

Fossil cliffs at Awakeri delineate the previous coastline. The Rangitaiki and Tarawera Rivers in particular have deposited and built up the western side of the plains by lateral flooding of pumice sand, following large volcanic eruptions such as the Taupo pumice eruption of 186 AD and following the Kaharoa eruption *c.* 770 years ago, and at earlier times (Kear 1997).

The western half of the plains is sinking continuously (Kear 1997) but, in the past, this ground subsidence has been more than balanced by sediment deposition. The large amount of pumice sand coming down the Rangitaiki and Tarawera Rivers did not completely fill the eastern plains and linear coastal sand spits were formed from time-to-time (Kear 1997; refer to Figure 3). These spits were parallel to the coast and show the position of the coastline as it moved to its present position (Kear 1997). Swampy peat areas formed between the sand spits.

The present coastline is *c.* 10 km from the Awakeri cliffs and the progradation rate has been calculated at 9.75 km over the last 8,000 years and 6.5 km over the last 5,500 years, with a reduced rate since 186 AD (Pullar and Selby 1971).

The "Kaharoa" eruption of Mt Tarawera *c.* 1350 AD was followed by a catastrophic flood which devastated the Tarawera River valley and the Rangitaiki Plains (Hodgson and Nairn 2000). Lake Tarawera rose to more than 30 m above present levels and the collapse of the dam that formed after the eruption lead to the lake falling by more than 40 m. This flood was the highest peak discharge of any flood in New Zealand in the last 10,000 years and spread out across the Rangitaiki Plains to reach the coast between Matata and Whakatane (Hodgson and Nairn 2000). A similar but smaller scale flood occurred in 1904, following the formation of a dam by the Tarawera eruption in 1886 (Hodgson and Nairn 2000).

In March 1987, two earthquakes centred below the graben occurred only minutes apart, with intensities of 5.2 and 6.6 on the Richter Scale. This caused a general subsidence of *c.* 2 m over *c.* 20,000 ha of the plains, with some deep rifts and horizontal displacements. Besides this, local surface depressions of up to 2.5 m have occurred where drainage has caused peat beds to dry out and shrink drastically.

Special geological features

There are at least four sites in the ecological district classed as special geological features and recorded in the geopreservation inventories of the Geological Society of New Zealand (Kenny and Hayward 1992). These include the Matata Fault, inland from Matata township; the Kawerau Geothermal Field; the Rangitaiki Plains cuspate foreland (a good example of an actively prograding foreland); the Edgecumbe fault scarp preservation site between Awakeri and McCracken Road (the only section of the Edgecumbe fault scarp fenced and protected from human intervention), and various airfall tephras (e.g., Mangaone tephra).

Soils

Soils and their suitability for different land uses have been mapped and described by Pullar *et al.* (1978) and Pullar (1985). The overall pattern is a mixture of flood plain soils and soils formed in peaty backswamps, with sand dune soils along the coast and locally elsewhere.

To the west and inland, in the vicinity of the Tarawera and Rangitaiki Rivers, there is a large area of composite recent soils on yellow brown pumice. These are generally well-drained soils of former flood plains, although there are large areas that are poorly-drained. There are also strips of well-drained soils associated with the present flood plains of all the rivers.

Large areas of the plains are covered with soils formed in beach swamps and these include poorly drained silt loams, silt loam on peat, and peat over gravel.

There are also extensive areas of organic peaty swamp soils. In the eastern part of the plains these are subdivided by lenses of sandy soils formed from the dunes that comprised former coastlines.

There is a strip of very well-drained sand dune soils along the coast, extending up to *c.* 2 km inland.

Landform units

The survey area was divided into nine units based on landform (refer to Figure 3).

1. ***Alluvial Plain***

   The main, and very distinctive feature, as described in the section above on Geology and Physiography, includes a few scattered very low sand "rises", some of which are mapped in Figure 3—also see description below.

2. ***Wetlands***

   A very few sizeable remnants of the former extensive wetlands of the Rangitaiki Plains occur in the west, alongside and fairly near the Tarawera River. Minor areas, associated with small lagoons, occupy narrow gully floors along the edge of the Matahina Plateau.

3. *Low Sand Rises*

Areas of smooth to gently-rolling sandy land, nowhere more than 7 m above base level, occurring at intervals and aligned parallel to the coast in the eastern quarter of the district, and rarely in the west (near Matata). They are the remaining emergent expressions of otherwise buried thick deposits of windblown sand.

4. *Sand Dunes*

Linear fixed dunes, considerable areas of blowout dunes, and local parabolic dunes, occur as a band a few hundred metres to 2 km wide behind the beach. This formation has been widely modified by sand mining, local residential, and other development.

5. *Oceanic Beach*

A sand beach occurs along the slightly convex coastal front of the district. As with other central Bay of Plenty beaches, it accretes markedly in summer but is eroded during winter.

6. *Lakes/ponds*

Small lakes and ponds are present at various locations (e.g., Lake Tamurenui) and are remnants of the formerly more estuarine wetlands. Some have been excavated for game bird shooting (e.g., Kohika).

7. *Intertidal flats*

Limited areas in the Whakatane River Estuary.

8. *Estuarine channels*

Also limited areas in the Whakatane River Estuary.

9. *Rivers*

A summary of landform units for each of the two bioclimatic zones is presented below in Table 1.

Table 1: Summary of the representation of landform units in the coastal and semi-coastal bioclimatic zones, Te Teko Ecological District

LANDFORM UNIT	COASTAL (%)	SEMI-COASTAL (%)
Alluvial plain	19.54	91.93
Wetland	2.15	1.82
Low sand rises	–	3.65
Sand dunes	67.46	1.12
Oceanic beach	3.76	–
Lakes/ponds	1.88	0.38
Intertidal flats	1.22	0.02
Estuarine channels	3.22	0.10
Rivers	0.76	0.97
Total	100.00	100.00

Pre-human vegetation cover

This account is largely based on information provided in Gibbons (1990), Pullar (1985), Pullar *et al*. (1978), Pullar and Selby (1971), and Pullar and Patel (1972).

The Rangitaiki alluvial plains are very low lying, generally no more than 30 m asl, rising locally in the south to a maximum 40 m. Circa 1840, most of the northern two-thirds of the district was a vast, impassable, frequently flooded, wetland of swamps and peat bogs. The Rangitaiki River was perched between levees and diverged to join both the Whakatane and Tarawera Rivers behind a blocking 0.5-2 km wide belt of coastal sand dunes. East of a north trending line between the present hamlets of Awakeri and Paroa, low sand rises (exposed former dunes) occurred quite extensively; further eastward was the relatively well-drained flood plain of the Whakatane River. Alluvial flats, with only minor swamps, occurred in the south beyond the vicinities of present day Awakeri Hot Springs and Te Teko Township, and also along the western fringe of the plains.

The northern limit of the plains is the outcome of episodic aggradation during the last 7,000 years, through river transport and deposition of vast quantities of pumiceous rhyolitic tephra, plus some air fall, immediately following major volcanic eruptions inland: initially of Mamaku Ash in the Okataina area, east of Lake Rotorua; of the catastrophic and very voluminous Taupo Pumice 1550 years ago; and of the Kaharoa Ash and Lapilli from Mt Tarawera 900 years ago. Most of the water-sorted pumice and some coarse material, including large pumice blocks, would have been carried down the Rangitaiki and Tarawera Rivers. The Whakatane alluvial deposits consist mainly of greywacke silt and underlying gravels, with some layers of air-fall tephra. But much of the river-transported volcanic debris was swept out to sea, to be returned as wind blown sand; former dunes and associated peats underlie the Rangitaiki Plains to considerable depth.

It may be assumed that most of the pre-existing vegetation would have been destroyed during those brief phases of volcanically-triggered aggradation. But research throughout New Zealand has amply proven that indigenous forest soon reclothed naturally devastated land (in past ages before human influences). As one local instance, forest containing podocarps clearly several hundred years old had developed on the flanks of Mt Tarawera, source of the Kaharoa eruption, by the time of the 1886 event. Therefore, it may also be assumed that during the long intervals between the major aggradation events in the Te Teko Ecological District, indigenous forest would have covered all the better-drained ground. There is evidence to support this hypothesis. Tree logs and stumps were frequently encountered during excavations for drainage of the great wetland, indicative of a preceeding drier plain, and also elsewhere, including on pre-Kaharoa surfaces. All identified tree remains were either matai (*Prumnopitys taxifolia*), tōtara (*Podocarpus tōtara*), or kahikatea (*Dacrycarpus dacrydioides*), species characteristic of alluvial plains forest or semi-swamp. Soil profiles on the low sand rises in the eastern quarter of the plains indicate former occurrence of podocarps.

Human settlement and modification

Tangata whenua have resided on the Rangitaiki Plains for centuries and have major ongoing interests in the area. The main iwi within Te Teko Ecological District are Ngati Awa and Tuwharetoa ki Kawerau. Ngati Awa hapu are scattered across the district, with Ngati Pukeko at Poroporo, Ngati Hikokino at Te Teko; other hapu are Tuariki, Ngati Hāmua, Nga Maihi, Nga Tamaoki, Te Pahipoto, Ngai Tamawera, and Warahoe. The three main rivers are all significant to Ngati Awa. Tuwharetoa ki Kawerau are based in Kawerau but have links to the coast down the western side of the district. Ngati Rangitihi are based at Matata.

The long period of Māori occupation is reflected in the high level of cultural significance, with many waahi tapu sites, traditions, and histories associated with places across the plains.

Some important archaeological sites and urupa include the Kohika pa adjacent to the Tarawera River (which is nationally significant); Otaramuturangi urupa; Wahieroa, west of Walker Road; the pa at Lake Tamurenui; and the coastal strip between Otamarakau and Te Awa o Te Atua (the site of a battle).

Initial human settlement on the plains exploited particularly favourable localities either on the alluvial plains or where river courses intersect a sequence of ash-mantled dunes. On the plains, settlement and horticulture occurred in the vicinity of Whakatane, at Thornton, and adjacent to the lower Tarawera River. Fans and levees adjacent to the Whakatane and Rangitaiki Rivers were relatively little used for gardening and horticulture because of heavy soils and poor natural drainage. This contrasted with the fans and levees of the Tarawera River, consisting of free-draining ash alluvium (see Geology and Physiography), which were used extensively for gardening, especially in the vicinity of Onepu (Jones 1991).

The vast former wetlands on the plains also provided an extensive network of water-based travel routes and rich sources of food and fibre. There were extensive areas of ti kouka (cabbage tree; *Cordyline australis*), raupō (*Typha orientalis*), and harakeke (flax; *Phormium tenax*), and other useful plant materials. Podocarps, such as kahikatea, were common and would have provided seasonal sources of fruit and also seasonal food for birds were harvested. Fish and wetland birds were also in plentiful supply, with large seasonal runs of whitebait.

However, by about 1840, the prevalent vegetation on the dry periphery of the Rangitaiki Plains was bracken (rarahu; *Pteridium esculentum*) fernland and mānuka (*Leptospermum scoparium*)-dominant scrub, interspersed with Māori cultivations. The only at all sizeable area of mature indigenous forest was a stand of kahikatea on the Whakatane River flood plain (the since cleared "White Pine Bush") (not the same as White Pine Bush Scenic Reserve). The stand of Thornton kānuka present on the sand dune belt suggests an earlier common occurrence of Thornton kānuka forest along the sand dunes. Vestiges of kahikatea forest, with tītoki (*Alectryon excelsus*), tī kōuka, harakeke, toetoe (*Cortaderia fulvida* and *C. toetoe*), and mānuka bordered swamps, rivers, and streams in places. The vegetation of the great wetland would have comprised mainly harakeke, raupō, mānuka, and swamp coprosma (*Coprosma tenuicaulis*), and tracts of sedges and rushes and wetland ferns. There are historic records (pre-Taupo eruption *c.* 1890 years ago) of two more species which are not known to be present today. These are *Baumea complanata* and *Sporadanthus traversii*, identified from peat deposits at two sites—one near Awakeri and the other near Fermah Road (Campbell *et al.* 1973). It is not known whether these species would have recolonised after the Taupo eruption, to be present in early European times, prior to European clearance, drainage, and modification.

The coastal foredunes, in contrast to the modern situation, would have had a good cover of spinifex (*Spinifex sericeus*) and pīngao (*Desmoschoenus spiralis*), with low tangled shrubs (*Muehlenbeckia* spp.) and *Ficinia nodosa* behind the foredune. It should be remembered that tall forest would have occurred to the rear of the foredune prior to human clearance, and there are no remaining examples of original duneland sequences.

That almost total lack of forest on post-Kaharoa surfaces may be attributed to comparatively easy clearance of early-successional forest by Māori, who arrived in this district within, at most, 200 years after that eruption and consequent vegetation destruction, new raw surfaces, aggradation and subsequent increased frequency of river flooding. In the very favourable Bay of Plenty environment, the Māori population increased rapidly, and they

became assiduous cultivators of their own introduced crops, and, by the early 19th century of European food plants also.

The appearance of the plains in the late 19th century is described in Gibbons (1990). Excepting the sand dune fringe, most of the northern half was still a vast impassable wetland, with low swamp vegetation and peat bogs. The centrally placed, now perched, Rangitaiki River fed to the Whakatane and Tarawera Rivers before it ultimately swung westward behind the sand hills to a joint mouth with the Tarawera River.

Post-1890

An excellent history of human activity on the Rangitaiki Plains over the period 1890-1990 is provided by Gibbons (1990). Surveying of the plains for land subdivision started in 1890 and the first drainage board was formed in 1895. Another was formed in 1901 and achieved the drainage of *c.* 2,600 ha in the same year. A well-planned drainage programme was implemented, achieving reasonably large scale construction of main outlet drains, dredge cuts, and road drains (Gibbons 1990).

Most of the required drainage had been achieved by 1926, although there was ongoing annual maintenance and drain clearing. This meant that most of the plains were able to be planted in pasture and only relatively small areas remained as wetlands after that time. A series of larger floods in the 1960s, however, led to large scale construction of flood protection structures (mainly stopbanks), and major flooding ceased in 1973 (Gibbons 1990).

The Edgecumbe earthquake, on 2 March 1987, resulted in subsidence across large sections of the plains and considerable damage to flood protection stopbanks, which were rebuilt or reinforced.

Now, after many decades of drainage and flood prevention works, the plains are nearly entirely dairy farming and, locally, horticultural land. A network of drains lead to canals and the rivers which are lined with stopbanks. The Rangitaiki River has been diverted, near Thornton, to flow directly to the sea. Excavations frequently exposed stumps of large forest trees evidently overwhelmed by floods of Taupo Pumice alluvium nearly 2,000 years ago (Pullar and Patel 1972).

Approximately 6,000 ha of the Rangitaiki Plains now requires drainage pumping and Environment Bay of Plenty manages 34 separate communal pumping schemes. Land levels have also settled because of peat shrinkage and this has led to increasing problems with the operation of the drainage systems.

There are also hundreds of culverts on the major canals and drains, and many culverts and flapgate structures. The lower reaches of the rivers are confined within stopbanks designed to cope with "100 year" floods. The lower Rangitaiki River is stopbanked downstream of Te Teko and flows out to sea through a 1,500 m excavation developed in 1913.

The Tarawera River is stopbanked below State Highway 30 and the lower reaches of the Whakatane River have also been stopbanked, along with tributaries such as the Waioho Stream (partially diverted) and the Te Rahu and Orini Canals.

Flora

Lists of indigenous species (243) and naturalised species (320) have been compiled for the Te Teko Ecological District: refer to Appendices 1 and 2. Plant species lists are also available for many of the reserves and Recommended Areas for Protection (e.g. Beadel 1992a & b, and 1999a).

Threatened and local plants

Fifteen species present or recorded from the ecological district in the past are listed in the 2009 New Zealand Threat Lists (de Lange *et al*. 2009). A further 15 species present are considered to be regionally uncommon (from Beadel 2009). These are listed in Appendix 4.

Four of these species are nationally threatened, and are present or have been recorded from the ecological district in the past. *Utricularia australis* (classed as Threatened-Nationally Endangered) has been recorded from the Tumurau Lagoon and Lake Pupuwharau in the 1960s, but has not been seen since, despite several searches. 'Thornton kānuka' (*Kunzea* aff. *ericoides,* 'Threatened-Nationally Vulnerable') is common on rear dunes between the Tarawera and Rangitaiki Rivers, with smaller populations near Whakatane Airport and at Piripai Spit. Its taxonomic status is indeterminate. *Pimelea tomentosa* ('Threatened-Nationally Vulnerable') is present in RAP 19. Maawhai (*Sicyos* aff. *australis* (b)) ('Non-Resident Native-Coloniser') was recorded briefly in a maize crop at Ernest Road (NZFRI #26280).

Eleven 'At Risk' species are present or have been recorded in the past. *Cyclosorus interruptus* ('At Risk-Declining' in de Lange *et al*. 2009) occurs in 12 wetlands on the plains; some protected and some unprotected. Pīngao ('At Risk-Relict') occurs locally on the foredunes. New Zealand spinach (*Tetragonia tetragonioides*; 'At Risk-Naturally Uncommon') is known from one site on dunes at Matata. *Thelypteris confluens* ('At Risk-Declining' in de Lange *et al*. 2009) has been recorded from six wetlands and may be present at more. A very small population of *Dicranopteris linearis* ('At Risk-Naturally Uncommon') is present at the Pukaahu Spring (RAP 12). *Dianella haematica* ('At Risk-Declining') is present at Tumurau Wetland.

A large population of *Korthalsella salicornioides* ('At Risk-Naturally Uncommon') occurs on kānuka (*Kunzea* aff. *ericoides* (b)) on the Piripai Spit (P. Cashmore pers. comm.). *Coprosma acerosa* ('At Risk-Declining') is present at approximately five sites on the sand dunes between Tarawera and Rangitaiki Plains. Prostrate kānuka (*Kunzea ericoides* var. *microflora*) occurs at the geothermal area in Kawerau. Sand tussock (hinarepe; *Austrofestuca littoralis*) ('At Risk-Declining') was recorded near Matata (NZFRI 2500 voucher specimen) in 1949 but, despite searches, has not been seen since.

Fourteen species considered to be regionally uncommon (as per Beadel 2009) have been recorded from the ecological district: *Bolboschoenus caldwellii*, *Carex* aff. *raoullii* ("raotest"), *Empodisma minus*, *Epilobium chionanthum*, *Hypolepis distans*, *Melicytus novae-zelandiae* (coastal māhoe), *Oxalis rubens*, *Parietaria debilis*, *Pterostylis* aff. *montana* agg., *Ruppia* sp., *Sparganium subglobosum* (maru, burr reed), *Suaeda novae-zelandiae*, *Tetraria capillaris*, *Wolffia australiana*.

It is likely that as many as a further 16 species on the national list of threatened plants (de Lange *et al*. 2009) may have occurred in Te Teko Ecological District in the past: *Dactylanthus taylorii, Pterostylis micromega, Hibiscus richardsonii, Lepidium oleraceum, Ptisana salicina, Mazus novaezeelandiae* subsp. *impolitus, Euphorbia glauca, Sicyos* aff. *australis* (a), *Myriophyllum robustum, Peperomia tetraphylla, Pimelea villosa, Potamogeton pectinatus, Mimulus repens, Ranunculus limosella, R. macropus,* and *Tupeia antarctica*. None of these species are currently known to occur naturally in the ecological district, and some (e.g. aute taranga (*Pimelea villosa*) and *Euphorbia glauca*) can now be considered to be naturally extinct in the ecological district. CoastCare have recently undertaken planting of some of these species (*Lepidium oleraceum, Euphorbia glauca,* and sand tussock), along with pīngao, on sand dunes.

Fauna

The habitats of vertebrate and invertebrate fauna in Te Teko Ecological District have been heavily modified following the arrival of humans. Formerly extensive wetlands and flood plain forest would have provided habitat for a wide variety of birds, including nationally or regionally extinct species of moa, rails, ducks, raptors, wrens, and New Zealand wattlebirds. The rivers, wetlands, and estuaries would have supported abundant water birds, fish, shellfish, and crustaceans.

The arrival of Māori saw dramatic change, with direct depredation of some large fauna, e.g., moa, and the loss of many others as a result of the combined effects of predation by Pacific rats (kiore), kuri (Polynesian dog), and habitat loss (Worthy *et al*. 2002).

European settlement resulted in accelerated loss of habitats and the introduction of many more pest animals, such as predatory mammals, livestock and other browsing mammals, various birds, reptiles, amphibians, fish, and invertebrates, all of which have had negative effects on indigenous biodiversity. Species, such as pateke (brown teal; *Anas chlorotis*) and North Island piopio (New Zealand thrush; *Turnagra tanagra*) disappeared during this period (about 1900). Habitat loss and the risk of accidental introductions of invasive species continue to this day.

The Bay of Plenty Region was surveyed during the period 1982-84 by the former New Zealand Wildlife Service, to identify Sites of Special Wildlife Interest (SSWI) (Rasch 1989). More recent fauna surveys have been carried out along the coastal fringe of the Ecological District (Wildland Consultants 2001) and in the Kawerau area (Wildland Consultants 2002).

At least 26 threatened bird species (as defined by Miskelly *et al*. 2008) are present, most of which are coastal and/or wetland species. Threatened birds of the coast include small numbers of northern New Zealand dotterel (*Charadrius obscurus aquilonius*), banded dotterel (*Charadrius bicinctus bicinctus*) (both of which are heavily disturbed during the breeding season), reef heron (*Egretta sacra sacra*), Caspian tern (*Hydroprogne caspia*), white-fronted tern (*Sterna striata*), black-fronted tern (*Chlidonias albostriata*) (winter only visitors), black-billed gull (*Larus bulleri*), pied shag (*Phalacrocorax varius varius*), and black shag (*Phalacrocorax carbo novaehollandiae*). The estuaries and lagoons attract some of the above species, plus white heron (*Ardea modesta*), grey duck (*Anas superciliosa*), little black shag (*Phalacrocorax sulcirostris*), and New Zealand dabchick (*Poliocephalus rufopectus*). Dense reedlands fringing open water are preferred habitat of Australasian bittern (*Botaurus poiciloptilus*), banded rail (*Gallirallus philippensis assimilis*), North Island fernbird (*Bowdleria punctata vealeae*), spotless crake (*Porzana tabuensis tabuensis*), and marsh crake (*Porzana pusilla affinis*).

Important wetland habitats for various threatened species include the Rangitaiki River and adjacent lagoon (Thornton Wildlife Management Reserve), Tarawera River-mouth, Matata Lagoon (Matata Lagoon Wildlife Management Reserve) and nearby dune lakes. Other wetlands and rivers (e.g., the Whakatane River) provide important habitat further inland for several of these species, particularly shags, New Zealand dabchick, bittern, banded rail, crakes, and fernbird.

The Whakatane River estuary provides habitat for South Island pied oystercatcher, pied stilt, little shag, royal spoonbill, and red-billed gull, all of which are threatened species.

The forest avifauna of the Ecological District has been severely depleted due to the widespread loss of habitat. The few threatened species that still occur locally or are itinerant visitors, include New Zealand falcon (*Falco novaeseelandiae*), North Island kaka (*Nestor meridionalis septentrionalis*), and long-tailed cuckoo (*Eudynamys taitensis*). Kaka are only

occasional visitors and are occasionally seen flying across the plains, travelling between Ohope and Matata.

The New Zealand pipit can be observed on the coastal dunes and adjacent rough pasture lands.

There is one historic record of long-tailed bats in Whakatane and it is possible that they still use forest remnants, particularly if there are large trees present that can provide suitable roosting cavities (c. f. O'Donnell 2000).

Limited work has been carried out on reptiles and amphibians. Shore skinks (*Oligosoma smithii*) are likely to be present along the coast, and indigenous snails (small species only) are likely to be present in some natural areas. Introduced frogs (*Littoria* spp.) are present in many wetlands.

Little is known about invertebrates in remaining natural areas, although it is very likely that they provide important habitats for a diverse range of species. Indigenous New Zealand insects are intimately associated with indigenous habitat, and carry out a wide range of roles in ecosystems. It is generally acknowledged that, although there are many 'generalist' species of insects, the great majority have particular habitat requirements that restrict their populations in both space and time. Of an estimated 20,000+ insect taxa in New Zealand, approximately 80-90 percent were considered to be endemic by Watt (1975, 1982): 'few native insects have been able to adapt themselves to the drastically changed habitats caused by humans, especially Europeans, wherever they have used (and frequently misused) land for agriculture and industrial purposes or habitation. Most endemic insects are confined to natural or only slightly modified habitats, and do not seem to be able to adapt themselves sucessfully to altered environments'. There are many other known cases of localised endemism (e.g., Ramsay *et al.* 1988) and, as a consequence of perhaps 50 percent of our insects being as yet undescribed, there are certainly many more as yet unnamed ones. As Kuschel (1990) commented, 'even the relatively small bush patches which have so far escaped destruction may contain faunas of unsuspected richness and diversity'.

Many introduced mammals are widespread in the area. These include possums (*Trichosurus vulpecula*), hedgehogs (*Erinaceus europaeus*), feral cats (*Felis catus*), ferrets (*Mustela furo*), stoats (*Mustela erminea*), weasels (*Mustela nivalis*), ship rats (*Rattus rattus*), Norway rats (*Rattus norvegicus*), mice (*Mus musculus*), hares (*Lepus europaeus*), and rabbits (*Oryctolagus cuniculus*). Domestic dogs (*Canis familiaris*) and cats that wander into wetlands and coastal dunes and beaches also pose a threat to some threatened bird species. Red deer (*Cervus elaphus scoticus*) occur locally in at least one of the larger wetlands.

Freshwater fish

Te Teko Ecological District has experienced intensive hydrological modification, but nevertheless still has a rich diversity of indigenous freshwater fish. This can be attributed directly to its coastal location and to the diverse range of aquatic habitats which are important for resident species, migratory species, some estuarine species, and whitebait spawning. Recreational and commercial fishing values include local trout fishing, eeling, and whitebaiting.

Indigenous species include longfin eel (*Anguilla dieffenbachii*), shortfin eel (*Anguilla australis*), inanga (*Galaxias maculatus*), redfin bully (*Gobiomorphus huttoni*), giant bully (*Gobiomorphus gobioides*), common bully (*Gobiomorphus cotidianus*), common smelt (*Retropinna retropinna*), banded kōkopu (*Galaxias fasciatus*), giant kōkopu (*Galaxias argenteus*), koaro (*Galaxias brevipinnis*), torrentfish (*Cheimarrichthys fosteri*), and lamprey (*Geotria australis*).

Some indigenous species are of conservation concern. Longfin eel and giant kōkopu are ranked as 'Chronically Threatened-Gradual Decline', and lamprey and short-jaw kōkopu (*Galaxias postvectis*) are ranked as 'At Risk-Sparse'. (The latter has not been recorded but is present in the neighboring Taneatua and Otanewainuku Ecological Districts. Its apparent absence from the Te Teko Ecological District could be due to loss of suitable habitat or it could reflect the lack of field surveys in potentially suitable habitats.)

Two estuarine species have been recorded: yellow-eyed mullet (*Agonostomus forsterii*) and grey mullet (*Mugil cephalus*). Exotic species include mosquito fish (*Gambusia affinis*), which are abundant in remnant wetlands, canals and drains; goldfish (*Carassius auratus*), which are present in many drains and canals; rainbow trout (*Oncorhynchus mykiss*) and brown trout (*Salmo trutta*), which are present in the rivers.

The main aquatic habitats are the three main river systems—Tarawera, Rangitaiki, and Whakatane—and their tributaries, remnant freshwater wetlands, coastal freshwater lagoons, and a complex arrangement of drains and canals. Although species diversity is relatively high, overall population numbers are low for species such as giant kōkopu, banded kōkopu, and koaro. This can be attributed to the loss of or lack of access (fish passage restrictions) to suitable habitat. Other factors contributing to loss of species diversity or relative abundance within the district are modification to existing habitats and damage to whitebait spawning sites.

Most New Zealand indigenous freshwater fish species require access to the sea to complete their life cycles, and freshwater habitats in the Te Teko Ecological District are also important migratory pathways for access to upstream habitats, although the Matahina Dam is a significant barrier on the Rangitaiki River. They also provide downstream migratory pathways and staging areas for adult migrant eels on their way to spawning grounds at sea.

Another important aspect is the presence of whitebait spawning sites. These sites are essential for the maintenance of inanga populations and the associated whitebait recreational fishery. Spawning sites are typically located on the riparian margins of the upper saltwater wedge flooded by autumn spring tides. Sound management of spawning sites is critical to maintain the inanga population. Known spawning sites are discussed below in relation to the three major rivers.

Remnant lowland wetlands

In the absence of fish passage restrictions, typical species assemblages include longfin eel, shortfin eel, inanga, common smelt, common bully, and giant kōkopu. Unfortunately, however, almost all remaining wetlands have been cut off from their natural water supplies. Most water supply systems are either flapgated, stoplogged, or dammed with weirs to manipulate the water regime, thus severely restricting fish passage. The usual species assemblage now only includes longfin eel, shortfin eel, goldfish, and mosquito fish.

Drains and canals

Drains and canal systems provide important habitat for longfin eel, shortfin eel, and inanga. The drains and canals also provide important migratory pathways for the larval migrants of species such as banded kōkopu, giant kōkopu, redfin bully, common bully, common smelt, and sometimes koaro. Goldfish and mosquito fish are common in drains and canals.

Flows through many of the drains and canals are controlled by tidal control gates, floodgates, or pump systems to transfer water to downstream waterways and these structures present significant restrictions to fish passage. Low oxygen levels and poor water quality also impact on species able to survive there.

Coastal lagoons

There are two coastal freshwater lagoons: Thornton and Matata. The 1987 Edgecumbe earthquake breached the Thornton Lagoon causeway and, during reconstruction, the previous culvert which enabled fish passage was not replaced. As a result, fish diversity in Thornton Lagoon is lower than could be expected. A recent survey found abundant shortfin eel, longfin eel, common bully, and mosquito fish. Common smelt and goldfish are also present.

The Matata Lagoon has a greater diversity of freshwater species, related to the relative ease of access to the sea. Strickland (1993) provided the following summary of the fisheries values of Matata lagoon:

"*Fourteen species of fish and two species of shrimp have been recorded in the Matata Lagoon system. Of the 14 species, 11 were found in the lagoon proper. Species with a marine stage to the life cycle were not found in the lagoon during the April 1993 survey, and could be expected there at times of the year when the various fish life cycle stages are migrating through the lagoon or utilising the lagoon as a staging area.*"

Shortfin eel, common bully, and mosquito fish are abundant. Common smelt, banded kōkopu, inanga, giant kōkopu, yellow-eyed mullet, grey mullet, longfin eel, and giant bully have also been recorded. Redfin bully were not found in the lagoon proper but are present in tributary streams.

Tarawera River

Species commonly found in the lower Tarawera River include shortfin eel, longfin eel, common bully, redfin bully, giant bully, inanga, mosquito fish, and goldfish. Giant kōkopu and rainbow trout are less common. Torrentfish, banded kōkopu, lamprey, and koaro utilise the river as a migratory pathway.

Longfin eel, shortfin eel, redfin bully, torrentfish, common bully, and inanga are typical of most tributaries, and giant bully, banded kōkopu, lamprey, and rainbow trout are also present in several tributaries. Giant kōkopu are present in the Waikamihi Stream and koaro in the Mangaone Stream, the only population recorded in the ecological district.

Rangitaiki River

This is perhaps the most modified river in the district as fish passage is severely restricted by two hydro-electricity dams situated in the Kaingaroa Ecological District. The only major tributary in the lower catchment is Reids Central Canal, which meets the river close to the coastal outlet at Thornton.

Indigenous species include inanga, longfin eel, shortfin eel, common bully, giant bully, common smelt, banded kōkopu, giant kōkopu, and torrentfish. Koaro whitebait have also been recorded (Saxton *et al*. 1987), and exotic species include brown trout, rainbow trout, goldfish, and gambusia.

One whitebait spawning site has been recorded, downstream of the SH2 bridge (Mitchell 1990). The river mouth is a popular location for whitebaiting and kahawai fishing, and the river is used for trout fishing.

Whakatane River

The Whakatane River is the least modified of the three rivers in the district, having retained its original outlet to the coast and channelisation of the lower reaches has been less intensive, although there has been major infilling of the estuary and a diversion of the river channel. To date there has been little survey work in the lower catchment but it is likely that

the river supports communities similar to the lower Rangitaiki and Tarawera Rivers. It also provides an important migratory pathway. Only one inanga spawning ground is currently known—on the island just upstream of the SH2 road bridge. Brown trout are present in the lower Whakatane River, and there is recreational fishing in this section of the river.

Relation to adjoining ecological districts

Four other ecological districts (refer to Figure 1) abut the Te Teko Ecological District (McEwen 1987):

- ***Taneatua*** includes the rolling to steep country to the east and inland of Awakeri. The hill country is divided by the flood plains of the Whakatane and Waimana Rivers. There is a coastal margin of cliffs and a strip of dunes at Ohope. Ohiwa Harbour is a notable feature of this district. Basal geology varies, including siltstones, sandstones, and conglomerates, and local ignimbrite.
- ***Kaingaroa*** includes all of the Kaingaroa Plateau, the low hills between Awakeri and Matahina, and Putauaki (Mt Edgecumbe). Mainly underlain by Matahina ignimbrite and large amounts of air fall tephras.
- ***Otanewainuku*** includes the coastal cliffs at Matata and the steep margin of the Kaharoa ignimbrite plateau that rises abruptly on the western side of the plains, delineating the eastern edge of the Manawahe hill country. Predominantly dissected ignimbrite plateaus, mantled with volcanic tephras.
- ***Rotorua Lakes*** includes a band of low hills between State Highway 30 and Kawerau, the hilly outskirts of the Rotoiti pumiceous volcanic breccia fan, mantled with air fall tephras. Geothermal areas are scattered throughout, such as Parimahana Scenic Reserve near Kawerau.

3. Outline of survey methods

Te Teko Ecological District was subdivided into landform units (based on its component geological formations and their physiographic characteristics) and bioclimatic zones (see descriptions above) to provide frameworks for the assessment of representativeness.

Collection of field data

Existing ecological information was compiled from published and unpublished sources (see References and Selected Bibliography). Many natural areas had been described and mapped in earlier studies (e.g., Beadel *et al.* 1996b). These sites were not revisited, and hard copy maps prepared for the 1996 report have been re-used in this report in some instances. Potential study sites not previously reported on were identified using topographic maps, aerial photographs, and cadastral maps. Study sites were delineated on aerial photographs, and were then inspected on the ground or viewed by binocular, subject to access approval by landowners. This was mostly undertaken in 1997, with some sites visited in 2003. Field data was collated using the field data collection sheet in Appendix 8. Vegetation classes or types were determined in the field and marked onto hard copy aerial photographs (scale 1:25,000).

Evaluation

Broad vegetation cover was mapped at a scale of 1:50,000 into a Geographic Information System (GIS) using digital aerial photographs which were a mixture of images (black and white) from summer 1995 and summer 1996 (see Figure 5 and Appendix 12). The boundaries of bioclimatic zones and landform units were overlaid at the same scale and RAPs were selected to obtain as good as possible representation of landforms, climate, and vegetation. Historical context was also taken into account, to provide a framework to assess the past and potential ecosystem types of the ecological district.

The criteria used for evaluation were those outlined by Myers *et al.* (1987) and expressed by Leathwick *et al.* (1995), as follows:

Representativeness	The primary criterion, based on a comparison of present vegetation cover vs past extent, diversity and pattern, naturalness, and size.
Diversity and Pattern	The diversity of ecological and physical features, and the patterns that exist within an area under consideration.
Naturalness	The degree to which the vegetation and habitats reflect likely natural character. Most mainland ecosystems are modified but the degree of naturalness is an important consideration.
Size and Shape	Areas which are relatively large (i.e. compared to the mean size of remaining areas of indigenous vegetation in an Ecological District) are preferred to small areas. Small areas can be affected strongly by edge effects. A compact single area is generally preferable to long narrow areas or small separate remnants.
Rarity and Special Features	The relative rarity of physical landscape features, vegetation, habitats and species within an ecological region or district or on a national basis (see de Lange et al. 2009, Miskelly et al. 2008, Hitchmough et al. 2007).
Buffering and Connectivity	The degree to which a natural area is protected or buffered by the surrounding landscape, or provides a buffer to other areas. A site may play an important role by connecting other areas of indigenous vegetation or habitat, or providing a riparian buffer.
Viability	The likelihood of an area remaining ecologically viable over time. Larger areas are generally more likely to remain viable with lower levels of management input.

Selection of Recommended Areas for Protection

Recommended Areas for Protection (RAPs) were selected using the above criteria, to provide representation of the following:

- The best quality or only remaining representative examples of indigenous vegetation or wildlife habitats not already protected on particular landform units within each bioclimatic zone. These sites contain some of the largest, best quality, or only remaining examples of indigenous vegetation or wildlife habitat, or intact altitudinal or geographic sequences across the ecological district, or diverse assemblages of landform units and vegetation within each bioclimatic zone.
- Relatively small sites with vegetation types or plant taxa under-represented or not represented in protected natural areas.
- Relatively large areas with features which are represented in protected areas but which are nevertheless worthy of protection.
- Sites containing vegetation types which would once have been more common in the ecological district and are unrepresented in protected natural areas but which have been degraded by weed invasion or animal damage, or similar.
- Interesting or special features, although the ecological unit(s) may be in a lower quality condition.

Presentation of information on each site

Fifteen fields have been used to present information on protected and unprotected areas, as follows:

- Te Teko Natural Area No.
- Grid Reference
- Area
- Landform Unit
- Status
- Bioclimatic Zone
- Vegetation
- Landforms
- Vegetation
- Flora
- Fauna
- Threat/Modification
- Discussion
- Notes
- References

Information on 'wild sites' not identified as RAPs is presented in Appendix 6 and includes a grid reference, extent (ha), a brief description of the vegetation cover, and vegetation types present.

Information on contiguous natural areas has been presented together, regardless of land tenure. For example, the Matata-Whakatane Dunes (Site No. 7) comprises the natural area which extends down the entire length of the coastline which is under numerous different tenure and management structures, including Wildlife Management Reserves (parts managed by Department of Conservation and parts of one reserve managed by Fish and Game New Zealand), recreation reserves administered by Whakatane District Council, and

covenants over private land. Sites which contain protected areas are presented first, and sites which are wholly unprotected are presented last.

The information provided in the "landform" field in the site records differs from landform units described in the text above (Section 2). Landforms listed in the landform field are defined in the glossary. They are the actual landform (i.e. wetland, flat, sand dune, hillslope) on which that vegetation type occurs in that site. These differ from the "landform units" mapped at a scale of *c.* 1:50,000 and used for broad scale assessment of the extent of the various classes of indigenous vegetation on the varying landform units.

4. What natural vegetation remains?

The extent of different vegetation classes and habitats in the coastal and semi-coastal bioclimatic zones has been calculated, based on the historical vegetation map (Figure 4; scale 1:100,000); refer to Table 2.

Current vegetation pattern is shown in Figure 5. A larger scale (1:35,000) map is presented in Appendix 10. Likely vegetation and habitats present *c.* 1840 has been compared with the remaining extent of indigenous vegetation and habitats in the coastal and semi-coastal bioclimatic zones; refer to Table 3.

It is readily apparent that there have been massive decreases in the extent of all major indigenous habitats. The largest decrease has been in the extent of freshwater wetlands, with only about 3 percent remaining in both the coastal and semi-coastal bioclimatic zones. The degree of change in the semi-coastal zone has actually been much greater than that indicated by simple analysis of data on extent. Most wetlands in the coastal zone, albeit highly modified, have retained a degree of naturalness (in terms of the vegetation and habitats present), and they have retained a semblance of natural hydrological processes. This contrasts markedly with most, if not all, wetlands in the semi-coastal bioclimatic zone which have highly altered hydrological processes, and the vegetation and habitats over large areas are now dominated by exotic species such as grey willow (*Salix cinerea*) and reed sweetgrass (*Glyceria maxima*). Some of these wetlands are still grazed (most were grazed until about 15–20 years ago), and some have also been excavated to create areas of open water habitat. It is now necessary to manage water levels and other threatening processes in nearly all semi-coastal wetlands if these habitats and their associated plant and fauna communities are to be retained.

A more detailed breakdown of current vegetation and habitats remaining on each of the landform units is provided in Appendix 5. Only *c.* 117 ha of freshwater wetland has been mapped as having a cover of indigenous species, for the entire ecological district. There is a further 118 ha with a mixed canopy of willows and indigenous species, and more than 298 ha of willow-dominant vegetation, much of which has an understorey of indigenous species.

A similar pattern is evident on sand dunes (refer to Table 3 and Appendix 5). Much of the vegetation remaining on dunes has been highly modified by a long history of burning and grazing and is now either dominated by exotic species (such as grasses and African boxthorn (*Lycium ferocissimum*)) or is a mixture of exotic and indigenous species (e.g. pōhuehue). There are only limited areas where indigenous species are dominant over reasonably large areas, and these are often confined to foredunes. A notable exception is the remnant area of 'Thornton kānuka' near Walker Road, which covers *c.* 37 ha.

It must be noted that, although highly modified, remaining areas of wetland and duneland that retain even a semblance of natural habitats are a very high priority for protection and active management to enhance ecological values. The justification is directly related to the high degree of alteration of the remainder of the ecological district, of which *c.* 94% has been converted to dairy farms, horticulture, and residential areas. Few vestiges of nature remain in this extremely modified environment, although drains do provide limited habitat for indigenous fish, and pasture grassland is utilised by common indigenous birds (e.g., pukeko, spur-winged plover, welcome swallow).

Table 2: Areas and percentages of historic vegetation and habitats in Te Teko Ecological District, c. 1840.

VEGETATION CLASS	BIOCLIMATIC ZONE						TOTAL	
	COASTAL			SEMI-COASTAL				
	Area (ha)[1]	% of BZ[2]	% of ED[3]	Area (ha)	% of BZ	% of ED	Area (ha)	% of ED
Estuaries and estuarine wetland	97.84	3.94	0.31	98.74	0.34	0.31	196.58	0.62
Freshwater wetlands, lakes and rivers	445.38	17.94	1.40	27,200.20	92.89	85.63	27,645.58	87.03
Mosiac of scrub, shrubland, fernland, secondary forest, modified primary forest and treeland	160.69	6.47	0.51	1,492.60	5.10	4.70	1,653.29	5.20
Podocarp forest on alluvial plains	0.00	0.00	0.00	134.91	0.46	0.42	134.91	0.42
Indigenous dune vegetation	1,778.40	71.64	5.60	355.61	1.21	1.12	2,134.02	6.72
Total	2,482.31	100.00	7.81	29,282.07	100.00	92.19	31,764.38	100.00

Table 3: Historic (c. 1840) and current vegetation and habitats in the coastal and semi-coastal bioclimatic zones of Te Teko Ecological District.

BIOCLIMATIC ZONE		VEGETATION CLASS													
		Estuaries and Estuarine Wetlands		Freshwater Wetlands, Lakes and Rivers		Mosiac of Scrub, Shrubland, Fernland, Secondary Forest, Modified Primary Forest and Treeland		Dune Vegetation (unmanaged)		Geothermal Habitat		Podocarp Forest on Alluvial Plains		Exotic	
		Ha[1]	%[2]	Ha	%	Ha	%	Ha	%	Ha	%	Ha	%	Ha	%
Coastal	Historic	97.84	3.94[3]	445.38	17.94	160.69	6.47	1,778.40	71.64	0.00	0.00	0.00	0.00	0.00	0.00
	Current	135.92	5.48	73.74	2.97	0.00	0.00	590.75	23.80		0.00	0.00	0.00	1,681.70	67.75
Semi-coastal	Historic	98.74	0.34	27,200.20	92.89	1,492.60	5.10	355.61	1.21	0.00	0.00	134.91	0.46	0.00	0.00
	Current	41.46	0.14	899.07	3.07	41.88	0.14	0.00	0.00	0.28	0.00		0.00	28,299.12	96.64
Total	Historic	196.58	0.62	27,645.58	87.03	1,653.29	5.20	2,134.01	6.72	0.00	0.00	134.91	0.42	0.00	0.00
	Current	177.38	0.56	972.81[4]	3.06	41.88	0.13	590.75	1.86	0.28	0.00	0.00	0.00	29,980.82	94.39

1. Ha = hectares
2. % of Te Teko Ecological District
3. % of relevant bioclimatic zone
4. This total includes c. 420 ha of river; the current extent of freshwater wetlands is c. 658 ha, c. 2.4% of original extent.

5. What values are currently protected?

Tabulated summaries of protected areas are provided below, with 19 areas protected for natural values. The Department of Conservation administers *c.* 415 ha of mainly freshwater wetland habitat, and also marginal strips along rivers and some protected duneland. There are also some small adjacent private land covenants (*c.* 16.2 ha). (Refer to Figure 6, which shows the location of protected areas.) In addition, there are *c.* 137 ha of wildlife management reserves administered by Fish and Game New Zealand (FGNZ). These areas are managed as game bird habitat by Fish and Game, and game bird hunters have an ongoing role in habitat management. These reserves should continue to be managed without compromising their natural values or future restoration options. An overview of the main types of protected areas is presented below, in Table 4. There is a strip of coastal reserves (*c.* 236 ha) administered by the Whakatane District Council, mainly recreation reserves. It is important to note that the primary purpose of a recreation reserve is recreation, rather than biodiversity protection, and that, with the exception of animals protected under the Wildlife Act 1953, recreational requirements generally over-ride biodiversity protection. Formal protection of the natural areas administered by Whakatane District Council is of high priority, particularly for Thornton kānuka forest (these areas have been identified for formal protection of natural values; see Section 6 below). In total, protected areas comprise 568 ha or 1.8% of the ecological district.

Table 4: Summary of currently protected natural areas based on natural values in Te Teko Ecological District.

TYPE OF PROTECTION	AREA (ha)
Lands administered by Department of Conservation	415.39
Covenants over private land	16.15
Wildlife Management Reserves administered by FGNZ	137.32
Total	568.86

Table 5: Summary of other reserves which contain natural values but which have other primary aims in Te Teko Ecological District.

STATUS	AREA (ha)
Whakatane District Council Reserves	235.71
Awaiti Wildlife Management Reserve (part)	53.91
Awakaponga Wildlife Management Reserve	8.16
Bregman Wildlife Management Reserve (part) (Tarawera Cut-Bregman)	4.57
Matuku Wildlife Management Reserve (Tumurau)	11.63
Thornton Wildlife Management Reserve (part) (Matata-Whakatane Dunes)	48.04
Orini Wildlife Management Reserve	11.02
Total	372.03

Breakdowns of areas administered by Department of Conservation and private lands protected with covenants are provided in Tables 6 and 7 below.

Table 6: Protected natural areas administered by Department of Conservation in Te Teko Ecological District.

NO.	NAME	BIOCLIMATIC ZONE(S)	STATUS	AREA (ha)
1a	Awaiti Wildlife Management Reserve (Awaiti) (part)	Semi-coastal	Administered by DOC	16.02
3	Lake Tamurenui Wildlife Management Reserve (part)	Semi-coastal	Administered by DOC	10.78
4a	Stewardship Area (Whakatane Estuary)	Semi-coastal		15.62
5a	Tarawera Cut Wildlife Management Reserve (Tarawera Cut-Bregman)	Semi-coastal	Administered by DOC	14.36
5b	Bregman Wildlife Management Reserve (part) (Tarawera Cut-Bregman)	Semi-coastal	Administered by DOC	4.07
7a	Matata Wildlife Refuge Reserve (Matata–Whakatane Dunes)	Coastal	Administered by DOC	114.65
7b	Thornton Wildlife Management Reserve (part) (Matata-Whakatane Dunes)	Coastal	Administered by DOC	49.25
7c	Piripai Spit Conservation Area (Matata–Whakatane Dunes)	Coastal	Administered by DOC	9.81
7k	Old Rangitaiki Stewardship Area (Old Rangitaiki River Channel)	Coastal	Administered by DOC	1.17
7l	Conservation Area (Matata-Whakatane Dunes)	Coastal	Administered by DOC	0.04
30	Old Rangitaiki Stewardship Area (Old Rangitaiki River Channel)	Coastal and semi-coastal	Administered by DOC	24.34
35	Rangitaiki River Marginal Strip (Part)	Semi-coastal	Administered by DOC	16.02
36	Awaiti Conservation Area	Semi-coastal	Administered by DOC	1.77
				410.81

Table 7: Private land protected with covenants in Te Teko Ecological District.

NO.	NAME	BIOCLIMATIC ZONE(S)	STATUS	AREA (ha)
6a	Tumurau Protective Covenant (Tumurau)	Semi-coastal	Department of Conservation Covenant	132.91
7h	Whakatane Conservation Covenants (Nos 24.3.03.1D, 24.3.03.1E)	Coastal	WDC Section 221 RMA Covenant	2.89
7i	Whakatane Conservation Covenants (Nos 61.8.1260.A, 24.3.96.40.J, 24.3.96.40.K)	Coastal	WDC Section 221 RMA Covenant	5.57
10	Wahieroa Wetland	Coastal	WDC Section 221 RMA Covenant	6.41
42	Onepu Pond	Semi-coastal	WDC Section 221 RMA Covenant	1.04
43	Steel Kānuka and Wetland	Coastal	WDC Section 221 RMA Covenant	0.24
				16.15

The size classes of protected areas are shown below, in Table 8. It is readily apparent that most protected areas are small (<20 ha) and that none are larger than 250 ha (the largest site is *c.* 200 ha).

Table 8: Size class distribution of protected natural areas in the coastal and semi-coastal bioclimatic zones[1] in Te Teko Ecological District (excludes Whakatane District Council reserves)

RESERVE SIZE	BIOCLIMATIC ZONE		
	COASTAL	SEMI-COASTAL	TOTAL
0–1 ha	2	0	2
1–10 ha	3	6[2]	9
10–20 ha	1[2]	7	8
20–50 ha	0	0	0
50–100 ha	1	1	2
100–250 ha	1	1	2
>250 ha	0	0	0
Total	8	15	22

1. Excludes reserves with no indigenous vegetation (e.g., Pukaahu Recreation Reserve, Whakatane District Council reserves, and minor parcels of Crown land marginal strips administered by the Department of Conservation listed in Appendix 7). Includes Rangitaiki River Marginal Strip.
2. One reserve extends across boundaries between coastal and semi-coastal bioclimatic zones, and the part in each zone has been included in these calculations.

6. What values need protection?

Key habitats that require better protection are coastal dunes, freshwater wetlands on the plains, and riverine ecosystems. Forty Recommended Areas for Protection (RAPs) have been identified, as listed below in Table 9, with locations shown in Figure 6. These sites include *c.* 235.7 ha of natural areas administered by Whakatane District Council which do not formally protect natural values (see Table 9).

The 40 RAPs comprise a significant proportion of natural areas remaining in Te Teko Ecological District.

Table 9: Recommended Areas for Protection (RAPs) in Te Teko Ecological District.

NO.	SITE NAME	BIOCLIMATIC ZONE(S)	AREA (ha)
4b	Whakatane Estuary	Coastal and semi-coastal	143.29
5d	Kohika	Coastal and semi-coastal	44.59
5e	Tarawera Cut Extension	Semi-coastal	4.11
6c	Tumurau North (Tumurau)	Semi-coastal	3.64
6d	Young Wetlands (Tumurau)	Semi-coastal	26.30
7e	Reserves administered by the Whakatane District Council (Matata-Whakatane Dunes)	Coastal	194.28
7f	Matata Recreation Reserve	Coastal	10.11
7g	Matata Lagoon Wildlife Refuge (Matata-Whakatane Dunes)	Coastal	27.54
7j	Matata-Whakatane Dunes (Part)	Coastal	180.13
9	Kopuatawhiti	Semi-coastal	22.63
11	Mangaone Stream Wetlands	Semi-coastal	4.07
12	Pukaahu Spring	Semi-coastal	0.04
13	Lambert's Wetland	Semi-coastal	18.65
14	Park Road Wetland	Semi-coastal	0.96
15	Onerahi Wetland	Semi-coastal	1.02
16	Lake Onerahi Wetland	Semi-coastal	28.86
17	Tarawera Road Wetland	Semi-coastal	2.13
18	Lake Tahuna Wetland	Semi-coastal	44.12
19	Lake Pupuwharau (Part)	Lowland	143.55
20	Eivers' Wetland	Semi-coastal	1.06
21	Lake Taikehu	Semi-coastal	4.49
22	Lake Otumahi (Part)	Semi-coastal	32.13
23	Tītoki	Semi-coastal	1.34
24	Ernest Pukatea	Semi-coastal	0.24
25	Waioho Kahikatea	Semi-coastal	1.17
26	Thornton Road Dunes	Semi-coastal	30.28
27	Braemar Road	Semi-coastal	1.36

NO.	SITE NAME	BIOCLIMATIC ZONE(S)	AREA (ha)
28	Needham Ponds	Semi-coastal	1.83
29	Orini Stream	Coastal	4.49
31	Tarawera River Willow Forest	Semi-coastal	3.54
32	Tarawera River Kānuka	Semi-coastal	2.12
33	Park Road Kānuka	Semi-coastal	6.01
34	Kawerau Road Kānuka	Semi-coastal	0.50
37	Keir Kānuka		2.40
38	Tarawera River	Coastal and semi-coastal	47.77
39	Rangitaiki River	Coastal and semi-coastal	134.16
40	Whakatane River	Coastal and semi-coastal	72.90
41	Braemar Road A	Semi-coastal	4.28
44	Walker Road Wetlands	Coastal	2.49
45	Tarawera River Raupō Wetland	Coastal	0.51
			1,255.09

The above tabulation (total area 1,255 ha; 4% of the ecological district) includes the Whakatane Estuary and the channels of the Whakatane, Rangitaiki, and Tarawera Rivers (*c.* 398 ha in total). If these are excluded, then the total area of RAPs in Te Teko Ecological District is *c.* 857 ha.

A list of more degraded 'wild sites' is provided in Appendix 6—these sites nevertheless provide opportunities for ecological restoration, particularly sites which have retained key ecological processes such as high water tables.

There is a strong justification for the protection of natural values in all natural areas remaining in the Te Teko Ecological District. Overall, the ecological district is a highly modified environment and many of the remaining 'natural areas' are also highly modified and many key sites are in private ownership. Retention of these sites as indigenous habitats will require ongoing active management to restore key ecological processes and to remove key threatening pest plant species. Restoration of hydrological regimes in wetlands and control of invasive pest plants in wetlands and on dunes are key requirements.

It is going to be essential to work closely with private landowners to achieve better management and protection of both protected and unprotected sites. Landowners and neighbours are often the key element in the retention or restoration of hydrological inputs to wetlands. Landowners are also going to require active support (technical advice and funding) to retain natural areas on their properties.

Without sustained active management, many natural areas in this ecological district will, over time, become exotic 'wasteland' with only limited value as indigenous habitats. It is very important that this does not occur, otherwise we risk the loss of largely 'irreplaceable' ecological features from this landscape.

7. Natural areas in Te Teko Ecological District

Protected natural areas

Protected natural areas administered by Department of Conservation

1a	Awaiti Wildlife Management Reserve (Awaiti) (Part)
3	Lake Tamurenui Wildlife Management Reserve (Part)
4a[1]	Stewardship Area (Whakatane Estuary)
5a	Tarawera Cut Wildlife Management Reserve (Tarawera Cut-Bregman)
5b	Bregman Wildlife Management Reserve (Part) (Tarawera Cut-Bregman)
7a	Matata Wildlife Refuge Reserve (Matata-Whakatane Dunes)
7b	Thornton Wildlife Management Reserve (Part) (Matata-Whakatane Dunes)
7c	Piripai Spit Conservation Area (Matata-Whakatane Dunes)
7k & 30	Old Rangitaiki Stewardship Area (Old Rangitaiki River Channel)
7l	Conservation Area (Matata-Whakatane Dunes)
35	Rangitaiki River Marginal Strip (Part)
36	Awaiti Conservation Area

Private land protected by covenant

6a	Tumurau Protective Covenant (Tumurau)
7h	Whakatane Conservation Covenants (Nos 24.3.03.1D, 24.3.03.1E)
7i	Whakatane Conservation Covenants (Nos 61.8.1260.A, 24.3.96.40.J, 24.3.96.40.K)
10	Wahieroa Wetland
42	Onepu Pond
43	Steel Kānuka and Wetland

Natural areas administered by Fish & Game New Zealand

1b	Awaiti Wildlife Management Reserve (Part)
2	Awakaponga Wildlife Management Reserve
5c	Bregman Wildlife Management Reserve (Part) (Tarawera Cut-Bregman)
6b	Matuku Wildlife Management Reserve (Tumurau)
7d	Thornton Wildlife Management Reserve (Part) (Matata-Whakatane Dunes)
8	Orini Wildlife Management Reserve

Recommended areas for protection

Reserves administered by the Whakatane District Council

7e	Reserves administered by the Whakatane District Council (Matata-Whakatane Dunes)
7f	Matata Recreation Reserve
26	Thornton Road Dunes

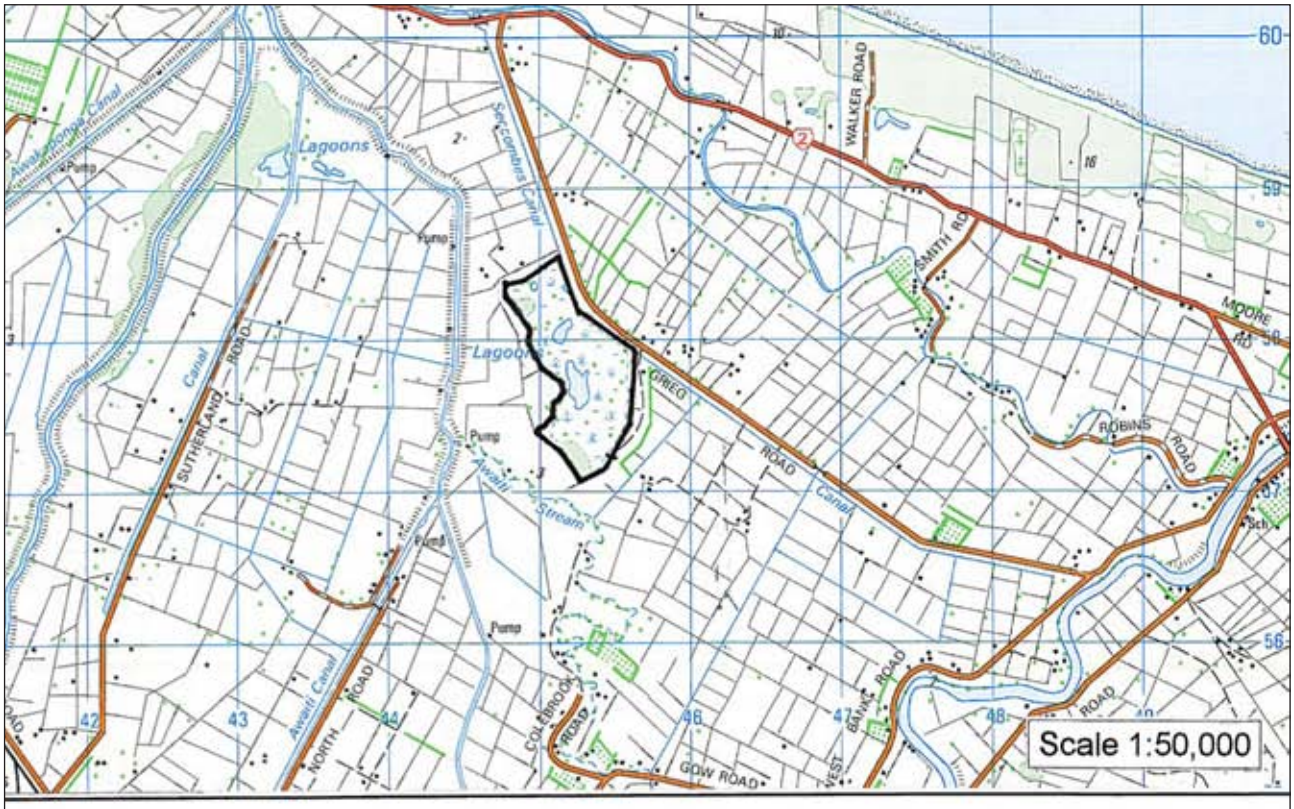
1 Lower case letter a-j are used to refer to parts of natural areas which are held under different land tenure, e.g. Matata-Whakatane Dunes includes several reserves (administered by three different authorities) and also land held in private tenure, e.g., 7a refers to Matata Wildlife Refuge, 7j refers to private land (uncovenanted), and a privately owned covenant is 7h.

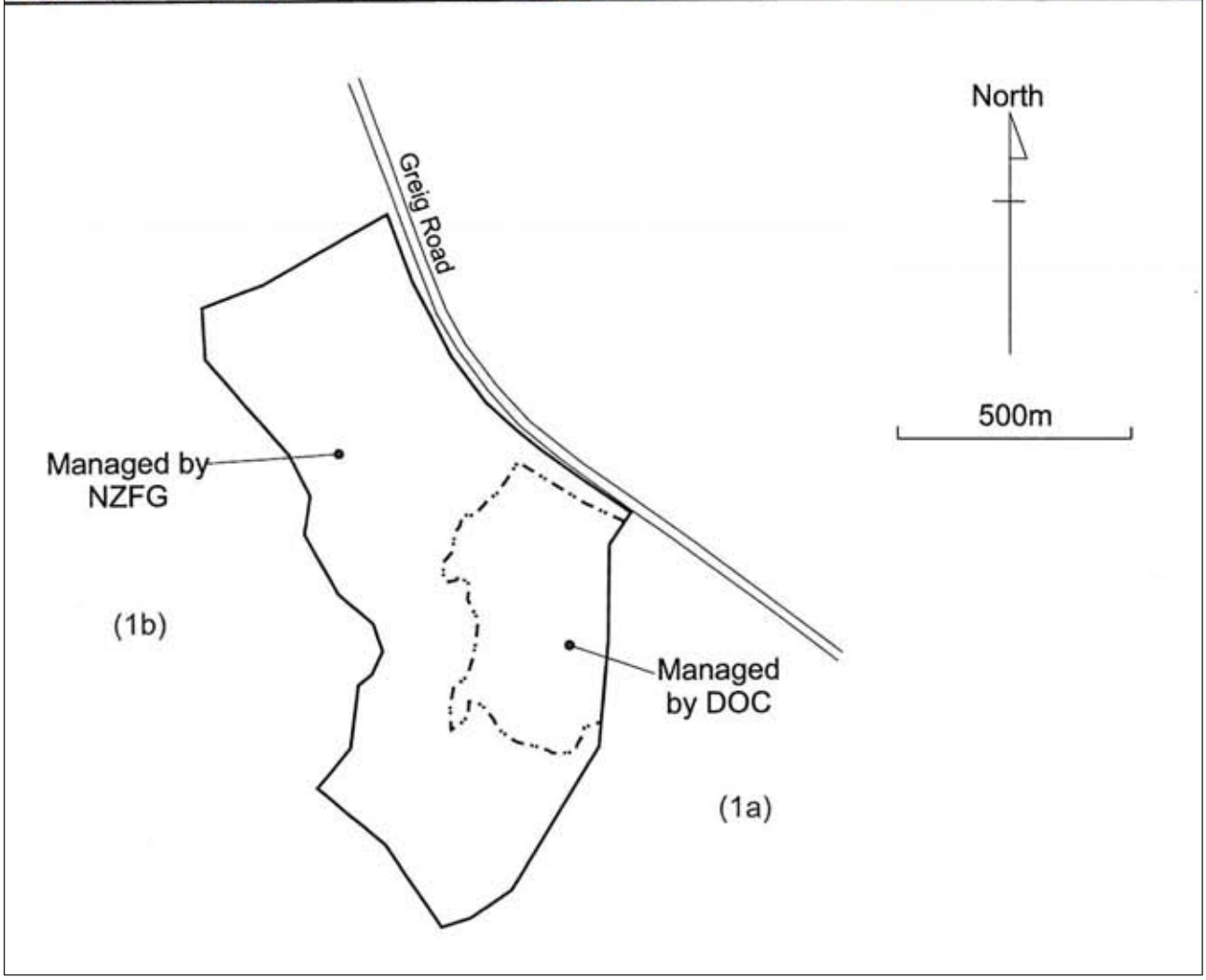
Other

4b	Whakatane Estuary
5d	Kohika (Tarawera Cut-Bregman)
5e	Tarawera Cut Extension
6c	Tumurau North (Tumurau)
6d	Young Wetlands (Tumurau)
7g	Matata Lagoon Wildlife Refuge (Matata-Whakatane Dunes)
7j	Matata-Whakatane Dunes (Part)
9	Kopuatawhiti
11	Mangaone Stream Wetlands
12	Pukaahu Spring
13	Lambert's Wetland
14	Park Road Wetland
15	Onerahi Wetland
16	Lake Onerahi Wetland
17	Tarawera Road Wetland
18	Lake Tahuna Wetland
19	Lake Pupuwharau (Part)[2]
20	Eivers' Wetland
21	Lake Taikehu
22	Lake Otumahi (Part)[2]
23	Tītoki
24	Ernest Pukatea
25	Waioho Kahikatea
27	Braemar Road
28	Needham Ponds
29	Orini Stream
31	Tarawera River Willow Forest
32	Tarawera River Kānuka
33	Park Road Kānuka
34	Kawerau Road Kānuka
37	Keir Kānuka
38	Tarawera River
39	Rangitaiki River
40	Whakatane River
41	Braemar Road A
44	Walker Road Wetlands
45	Tarawera River Raupō Wetland

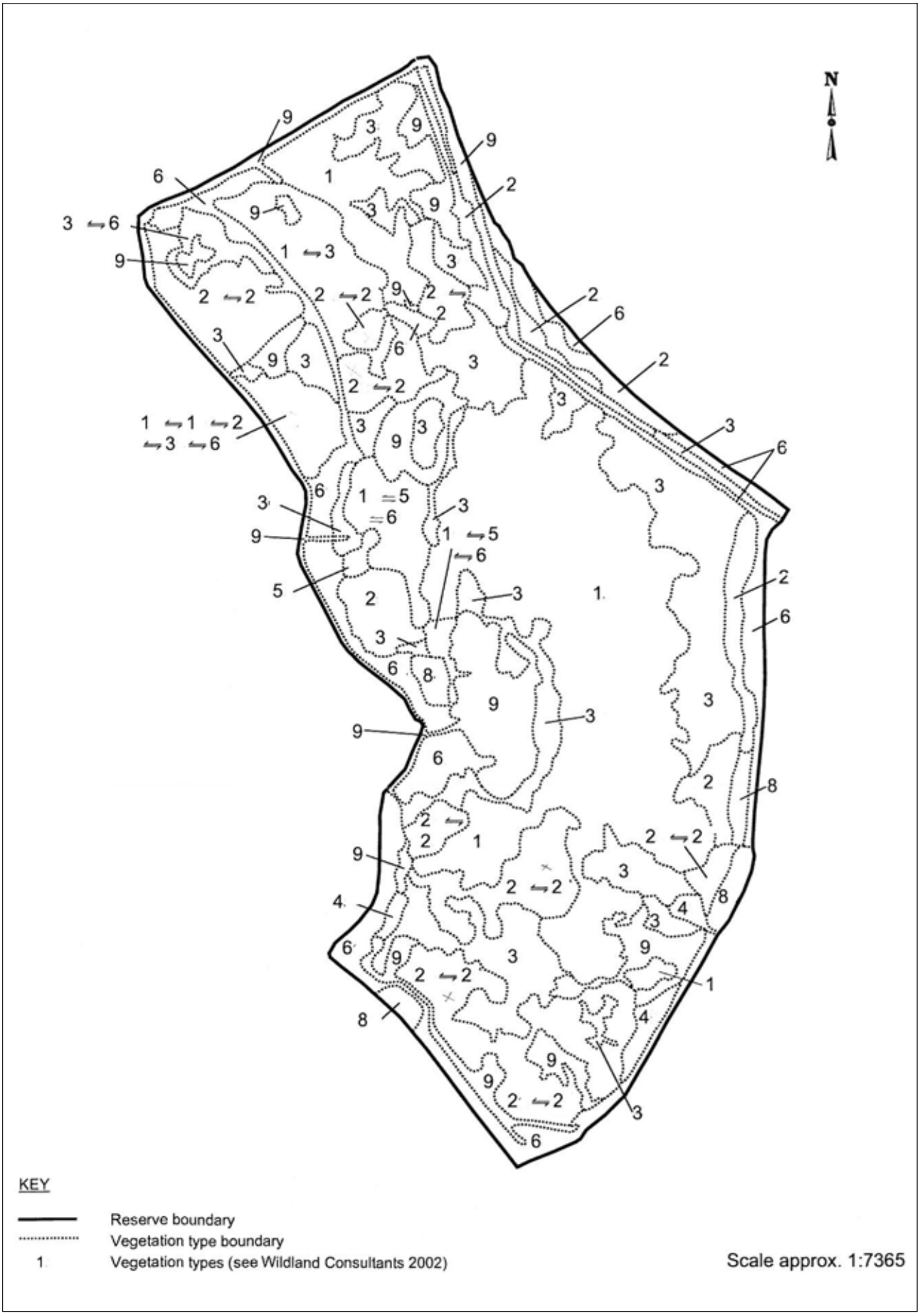
2 Part of this site lies in the Kaingaroa Ecological District.

1: Awaiti Wildlife Management Reserve





1: Awaiti Wildlife Management Reserve



Awaiti Wildlife Management Reserve

Te Teko Natural Area No. 1 (1a and 1b)
Grid Reference NZMS260 V15 452580
Area 16.02 ha; 53.91 ha
Landform Unit Wetland
Status This reserve is administered jointly by Department of Conservation (16.02 ha; 1a) and FGNZ (53.91 ha; 1b)

BIOCLIMATIC ZONE	VEGETATION	LANDFORM
Semi-coastal	1. Grey willow dominant.	Wetland
	2. Crack willow (*Salix fragilis*) dominant.	Wetland
	3. Raupō dominant.	Wetland
	4. Sedgeland.	Wetland
	5. Rushland.	Wetland
	6. Rough pasture.	Floodplain
	7. Fern-blackberry (*Rubus fruticosus* agg.)-inkweed (*Phytolacca octandra*) shrubland.	Floodplain
	8. Planted sites.	Floodplain
	9. Open water.	Pond
	(Wildland Consultants Ltd 2002)	

Vegetation

Willow dominates the canopy through much of the reserve, however it is now being controlled in the areas administered by DOC. Grey willow forest and treeland, with occasional tī kōuka, is the most common vegetation type, but in places grey willow also occurs in association with crack willow and ti kouka. Crack willow forest is prominent at both the northern and the southern ends of the reserve. Sedges, reeds and rushes are common under the willow forest canopy.

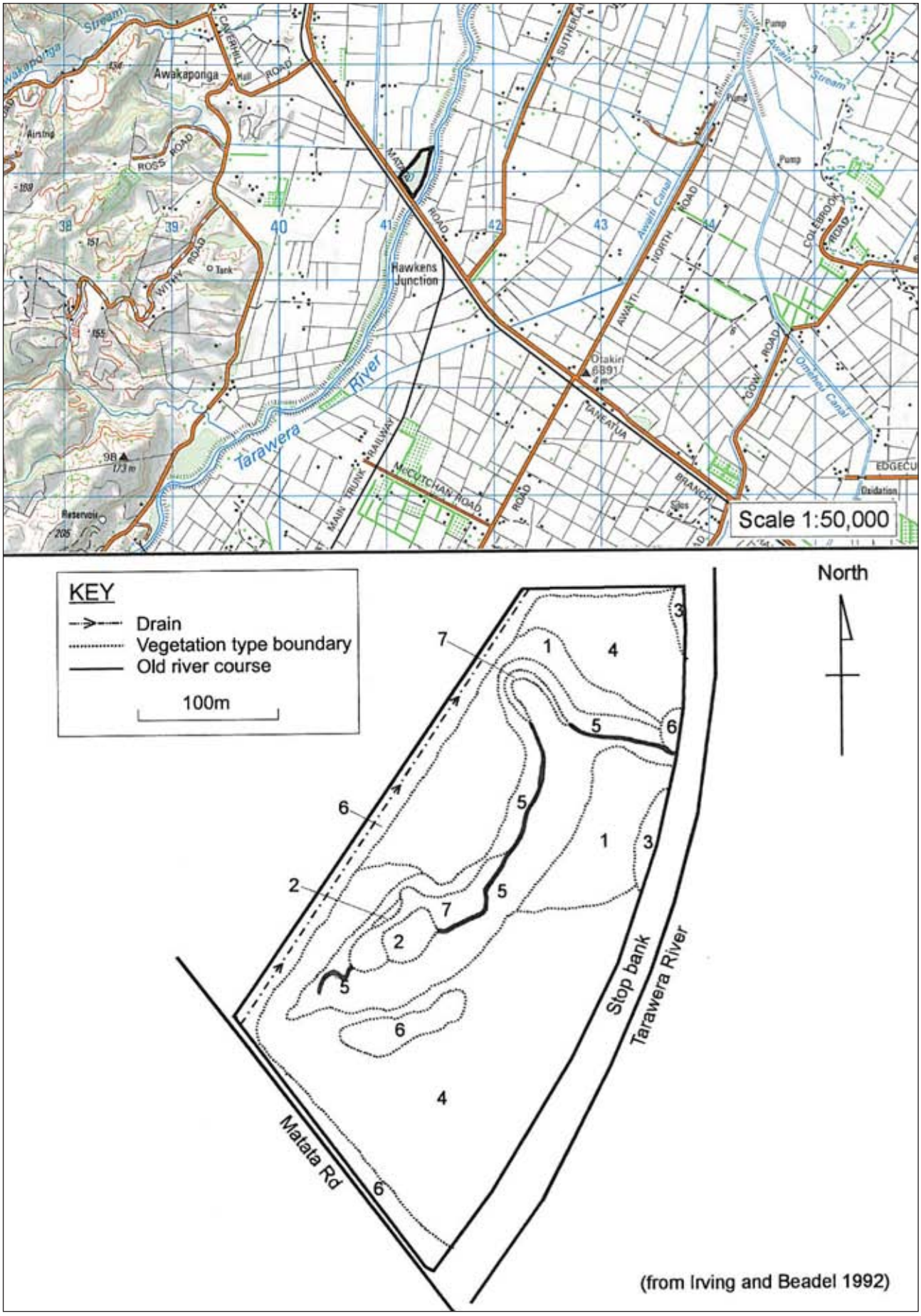
The shrub tier and ground cover is variable throughout the reserve. In places raupō is dominant, in association with carexes and *Cyperus ustulatus*, elsewhere giant spike sedge (*Eleocharis sphacelata*) and *Juncus* form extensive rushlands. Rough pasture and blackberry occurs around the reserve margins and along tracks, but *Cyperus ustulatus* and *Carex geminata* are now extending into the pasture sites.

Several areas of open water have been created and maintained by duck shooters. *Persicaria decipiens* and raupō are common on the water margin and dense mats of azolla and duckweed (*Lemna minor*) occur in both ponds and drains.

Parrot's feather (*Myriophyllum aquaticum*) is dominant in places and hornwort (*Ceratophyllum demersum*) is common in some ponds. Several parts of the reserve have been planted with both exotic and indigenous tree species.

	A full description of the vegetation is given in Wildland Consultants Ltd (2000b).
Flora	*Cyclosorus interruptus* (classed as 'At Risk-Declining in de Lange *et al*. 2009) occurs in the wetland.
Fauna	Rasch (1989) notes large numbers of waders, including Australasian bittern ('Threatened-Nationally Endangered' in Miskelly *et al*. 2008) and banded dotterel (Threatened-Nationally Vulnerable in Miskelly *et al*. 2008); fernbird ('At Risk-Declining' in Miskelly *et al*. 2008), and spotless crake ('At Risk-Relict' in Miskelly *et al*. 2008) present at this site.
Discussion	Wetlands originally covered thousands of hectares on the Rangitaiki Plains and only small fragments remain, most of which are highly modified. This area comprises one of the larger remaining examples of wetland vegetation in the Te Teko Ecological District. It contains a scattered population of *Cyclosorus interruptus* (Beadel 1992k).
References	Beadel 1992k; Miller 1983a; Wildland Consultants 2000b.

2: Awakaponga Wildlife Management Reserve



Awakaponga Wildlife Management Reserve

Te Teko Natural Area No. 2
Grid Reference NZMS260 V15 413559
Area 8.16 ha
Landform Unit Alluvial plain
Status Administered by FGNZ

BIOCLIMATIC ZONE	VEGETATION	LANDFORM
Semi-coastal	1. Grey willow/*Carex*-swamp millet (*Isachne globosa*) treeland.	Wetland
	2. Raupō reedland.	Wetland
	3. *Carex geminata* sedgeland.	Wetland
	4. (Grey willow)/reed sweetgrass treeland.	Wetland
	5. (Crack willow)-(grey willow)/mamaku (*Cyathea medullaris*)-whekī (*Dicksonia squarrosa*) forest.	Wetland
	6. Disturbed areas (including road banks, stopbanks, drain margins and pond excavations).	Wetland
	7. Open water.	Open water
	(Irving 1992e)	

Vegetation Much of this reserve is dominated by exotic species. This reserve comprises a mosaic of wetland vegetation—grey willow, reed sweetgrass, open water, with smaller areas of raupō reedland and *Carex geminata* sedgeland on better drained sites alongside the old river channel. Mamaku and whekī are common. (From Irving 1992e.)

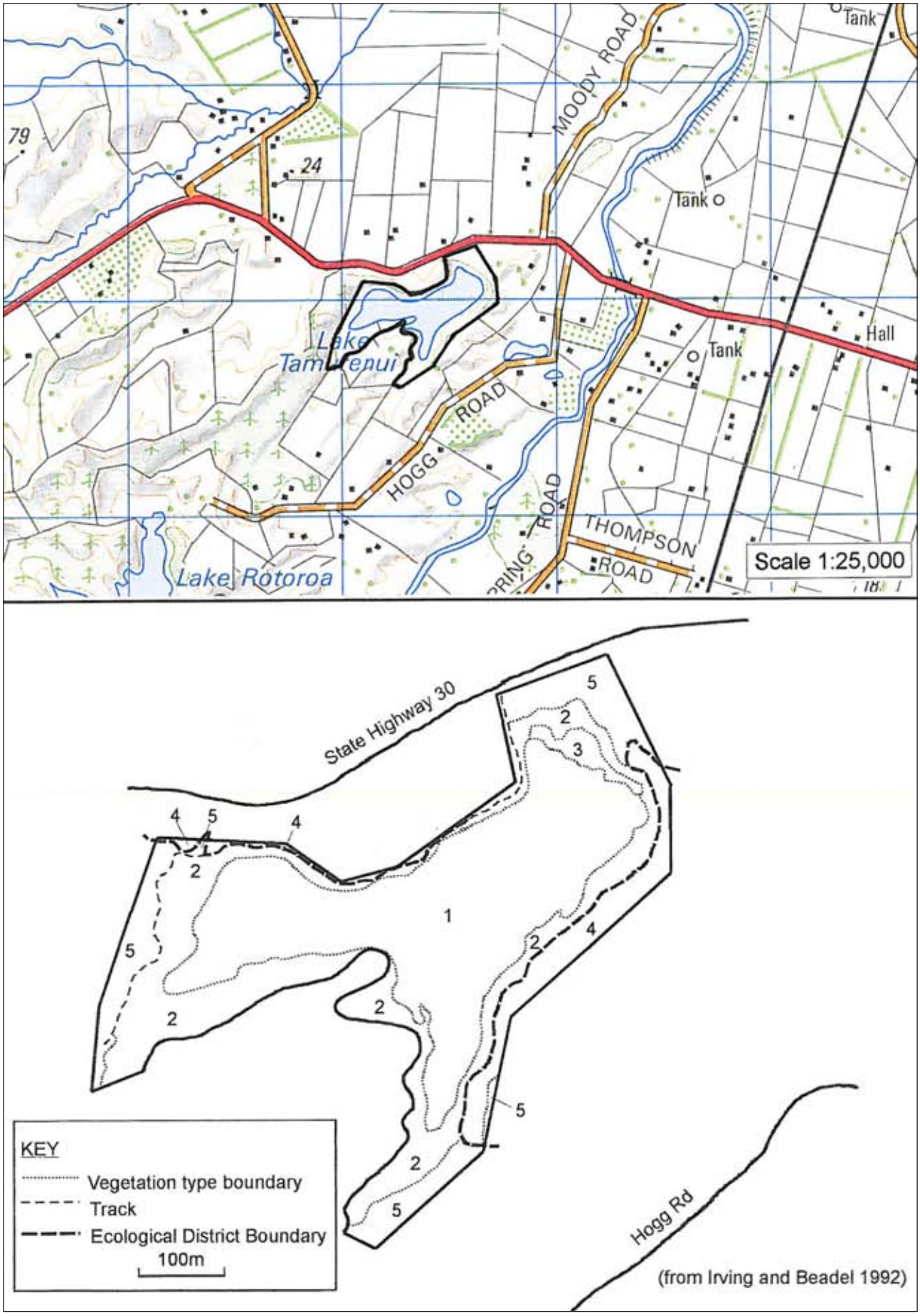
Flora A small colony of *Cyclosorus interruptus* (classed as 'At Risk-Declining' in de Lange *et al*. 2009) occurs in this reserve.

Discussion This reserve contains a small population of a rare fern (*Cyclosorus interruptus*).

References Beadel 1992k; Irving 1992e.

Footnote Wetland development and weed control was initiated in 2002 by FGNZ which has substantially altered the vegetation cover and landform, in particular reducing the area of willow-dominant forest and treeland present, and increasing the area of open water.

3: Lake Tamurenui Wildlife Management Reserve



Lake Tamurenui Wildlife Management Reserve (Part)[3]

Te Teko Natural Area No. 3
Grid Reference NZMS260 V15 373460
Area *c.* 10.78 ha (in Te Teko Ecological District)
Landform Unit Alluvial plain
Status Administered by Department of Conservation

BIOCLIMATIC ZONE	VEGETATION	LANDFORM
Semi-coastal	1. Open water.	Open water
	2. Grey willow forest and treeland, and mānuka shrubland.	Wetland
	3. Raupō reedland.	Wetland
	4. Kānuka forest (in Rotorua Lakes Ecological District).	Hillslope
	5. Pasture.	Flat, hillslope
	(Beadel 1992g)	

Vegetation A small lake surrounded by a generally narrow wetland dominated by grey willow, mānuka, sedges and raupō. The wetland fringe is wider in places extending up two small valleys.

Flora No threatened species have been recorded from this site.

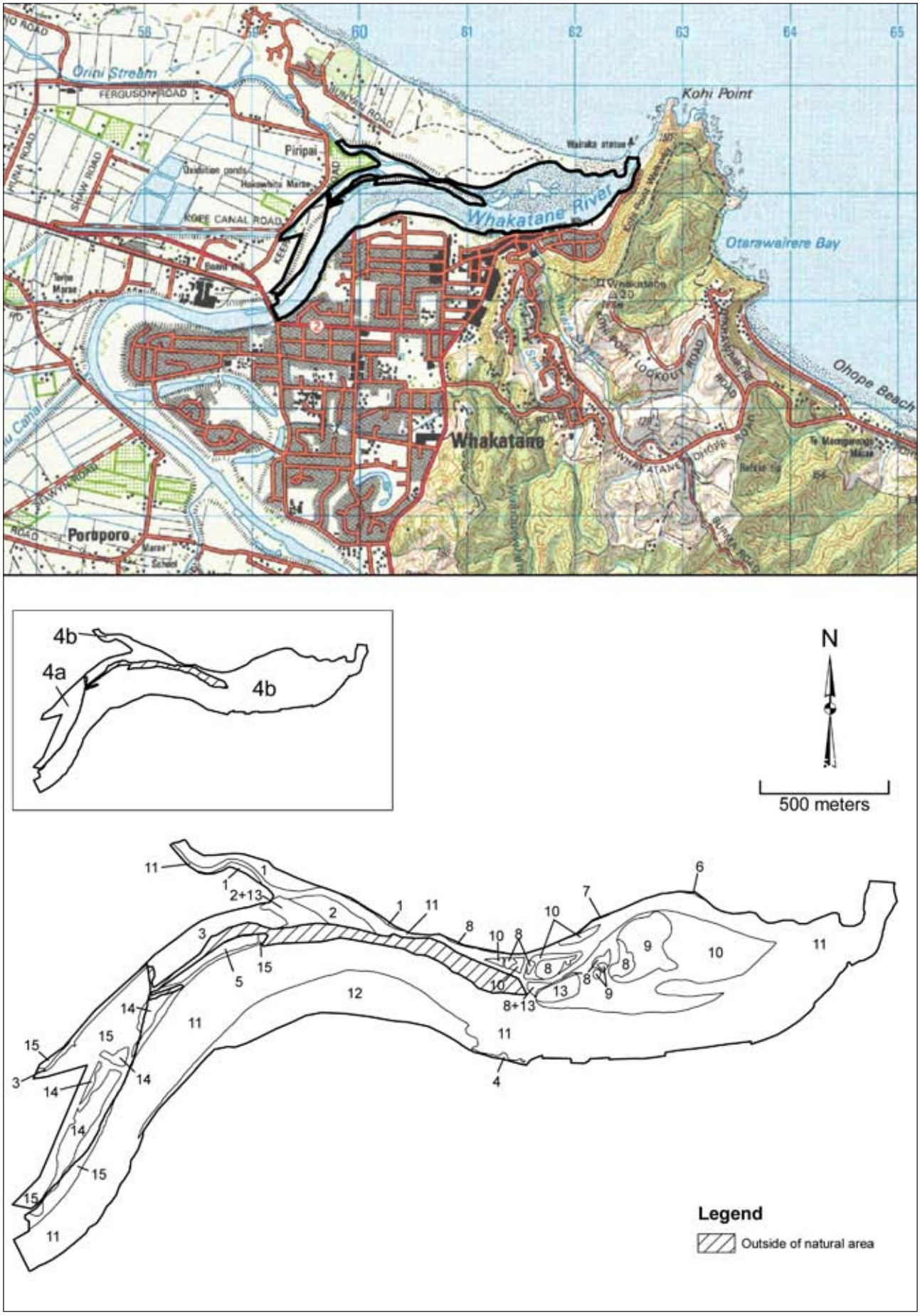
Fauna New Zealand dabchick (classed as At Risk-Declining; Miskelly *et al*. 2008) are present in this reserve.

Discussion The wetland vegetation around Lake Tamurenui is one of the few remaining examples of wetland vegetation around small lakes in the Te Teko Ecological District. Although it is modified, it still retains the main elements of its original composition and structure.

References Beadel 1992d&g; Ferguson 1996.

3 A small part of this reserve is in the Rotorua Lakes Ecological District (see map).

4 (4a–4b): Whakatane Estuary



Whakatane Estuary

Te Teko Natural Area No. 4 (4a, 4b)

Grid Reference NZMS260 W15 605540

Area 15.62 ha; 143.29 ha

Landform Unit Intertidal flats, alluvial plains, estuarine channels, wetland

Status Protected (shown as 4a[4] in the natural area map) and unprotected (4b)

Recommended Area for Protection Yes (4b)

BIOCLIMATIC ZONE	VEGETATION	LANDFORM
Coastal	1. Sea rush (*Juncus kraussi* var. *australiensis*) tussockland.	River flats
	2. Sea rush tussockland; marsh ribbonwood (*Plagianthus divaricatus*)/sea rush-oioi (*Apodasmia similis*) shrubland.	Estuarine wetland
	3. Sea rush/arrow grass (*Triglochin striata*) tussockland; *Bolboschoenus caldwellii*-raupō-marsh ribbonwood-sea rush reed-shrubland; open water.	Estuarine wetland
	4. Oioi-sea rush sedgeland.	Estuarine wetland
	5. Raupō reedland and pasture.	Estuarine wetland
	6. *Sarcocornia quinquefolia* herbfield.	Estuarine wetland
	7. Marsh ribbonwood/sea rush shrubland.	River flats
	8. *Schoenoplectus pungens* sedgeland; marsh ribbonwood-sea rush shrubland; sea rush tussockland.	Estuarine wetland
	9. Pampas (*Cortaderia selloana*) tussockland.	Estuarine wetland
	10. Intertidal flat (unvegetated).	Intertidal flat
	11. Estuarine channel.	Estuarine channel
	12. Pampas tussockland (with marsh ribbonwood/sea rush shrubland, *Bolboschoenus caldwellii* sedgeland, *Bolboschoenus fluviatilis-Bolboschoenus medianus* sedgeland, *Schoenoplectus pungens* sedgeland, bachelors button (*Cotula coronopifolia*) herbfield); crack willow/tall fescue (*Schedonorus arundinaceus*)-pampas grassland and treeland.	Estuarine wetland
	13. Rank pasture and pampas (with local exotic trees).	Estuarine wetland
Semi-coastal	*14.* *Schoenoplectus pungens* sedgeland; raupō reedland; arrow grass herbfield; bachelor's button herbfield; sea rush/arrow grass tussockland; *Bolboschoenus medianus*-raupō-marsh ribbonwood-sea rush reed-shrubland; *Bolboschoenus caldwellii* sedgeland; pasture.	Freshwater wetland Estuarine wetland River flats
	15. Raupō reedland; crack willow treeland; and pasture.	Freshwater wetland and river flats

Flora *Bolboschoenus caldwellii* occurs throughout the site.

Fauna Numerous water birds are present including royal spoonbill, reef heron, Caspian tern, and banded dotterel (Threatened-Nationally Vulnerable in Miskelly *et al.* 2008) (Rasch 1989).

4 Stewardship Area (administered by Department of Conservation; 15.4663 ha).

Whitebait spawn on the salt wedge (Hans Rook pers. comm.). Dabchick (Threatened-Nationally Vulnerable in Miskelly *et al.* 2008) and white heron (Threatened-Nationally Critical) also use the site.

Discussion

This site is relatively diverse and extends over parts of two bioclimatic zones, and includes examples of several landform units. It comprises the only sizeable examples of estuarine saltmarsh in the ecological district—minor examples are present adjacent to the Tarawera and Rangitaiki river mouths. This site is a representative example of the indigenous vegetation of the ecological district (cf. Beadel 1994a & 1995a).

The coastal section of the site was identified as of high botanical conservation value in Beadel (1994a).

This site includes a Stewardship Area (administered by Department of Conservation) in the semi-coastal zone which was identified as high botanical conservation value (Beadel 1995a).

There are local concentrations of pampas within this site.

The site is of significant wildlife habitat value. Several threatened species use the site. Whitebait spawn on the salt wedge and four threatened water birds use this site.

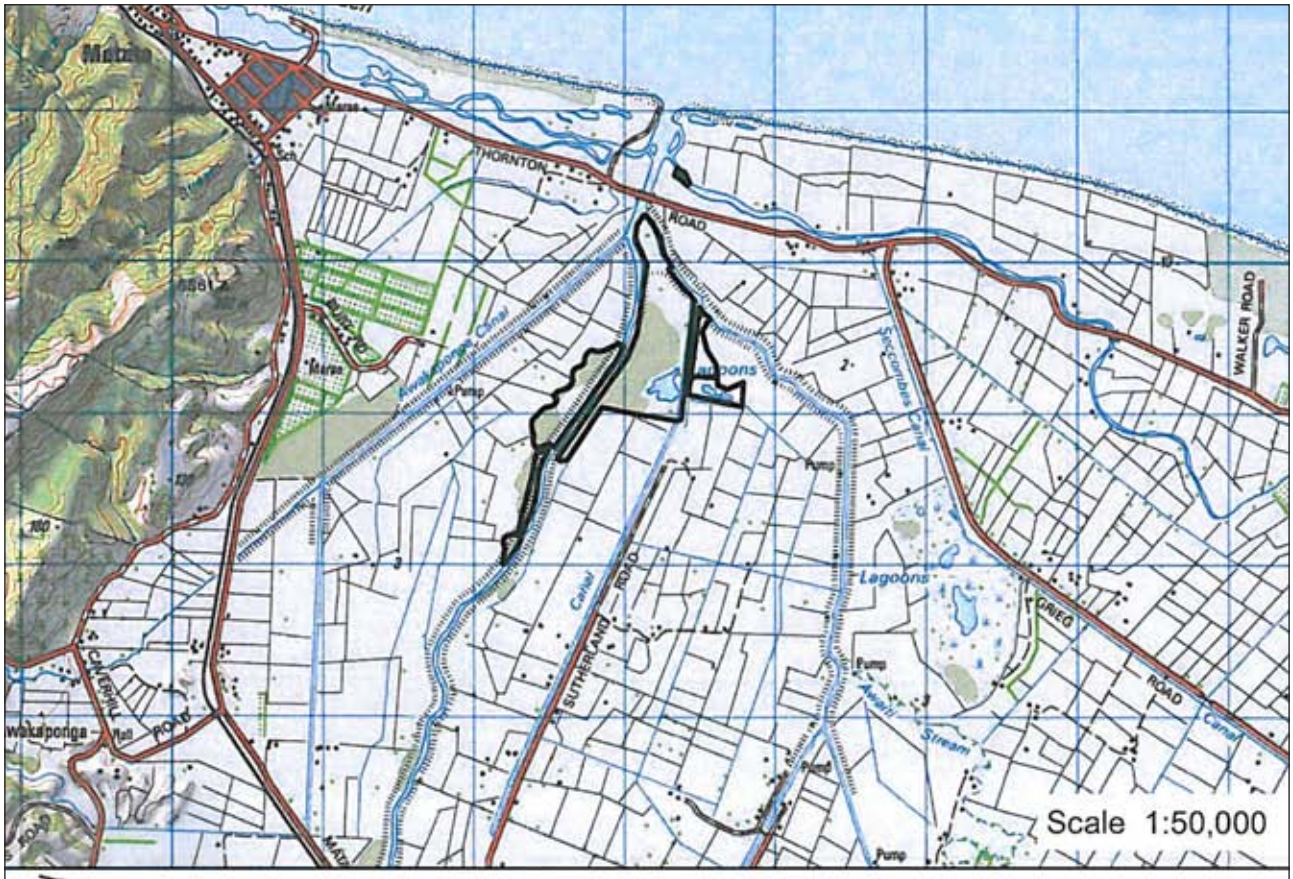
References

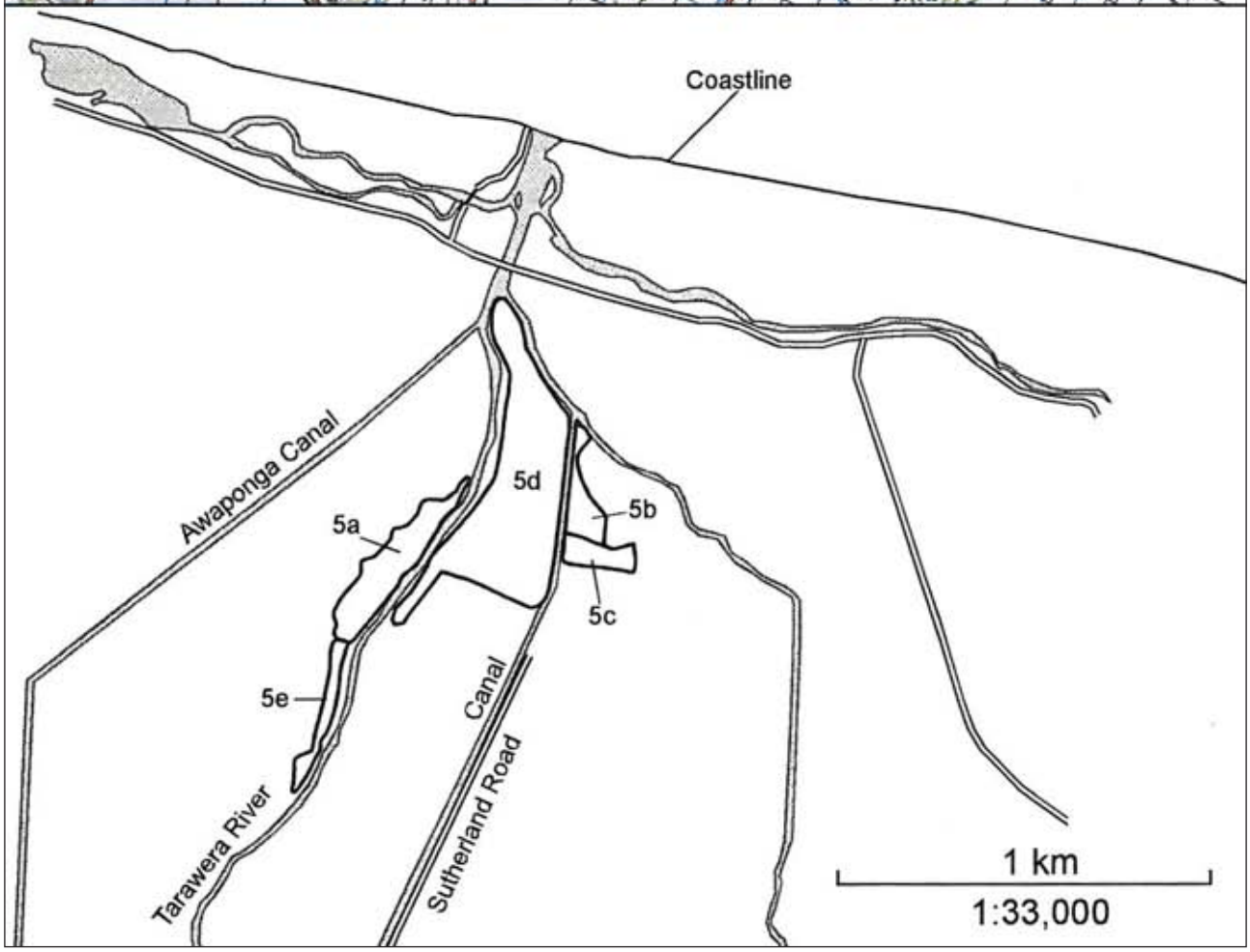
Beadel 1994a, 1995a & 1999a; Gosling & Beadel 2000b; Pike 1991.

Footnote

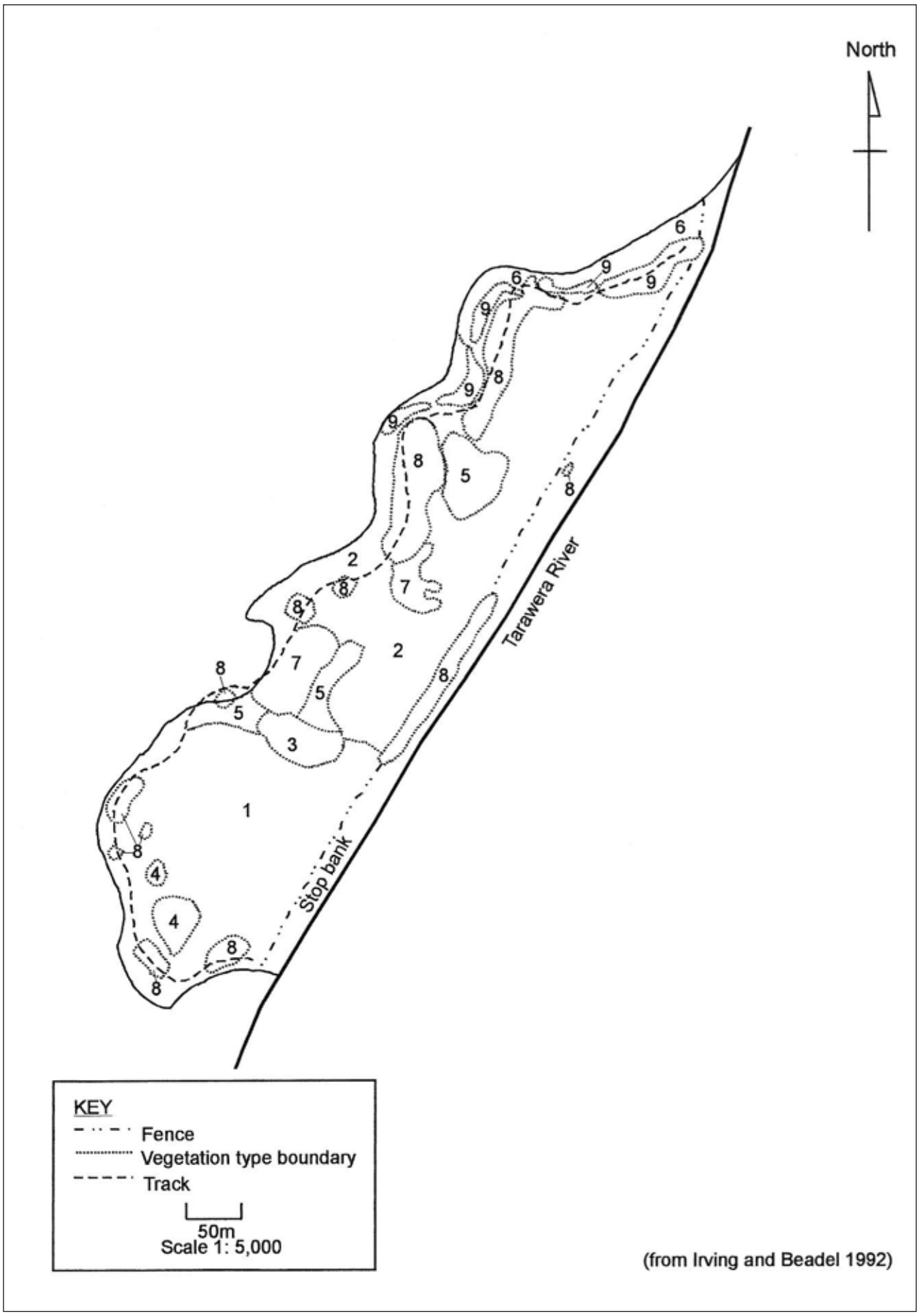
The riparian vegetation along the western margin of the Whakatane River (below the SH2 bridge) was mapped and described in 1999 (see Beadel 1999a). The Apanui saltmarsh (on the eastern side of the Whakatane River below the SH2 bridge) was mapped and described in 2000 (see Gosling and Beadel 2000b).

5 (5a–5e): Tarawera Cut – Bregman

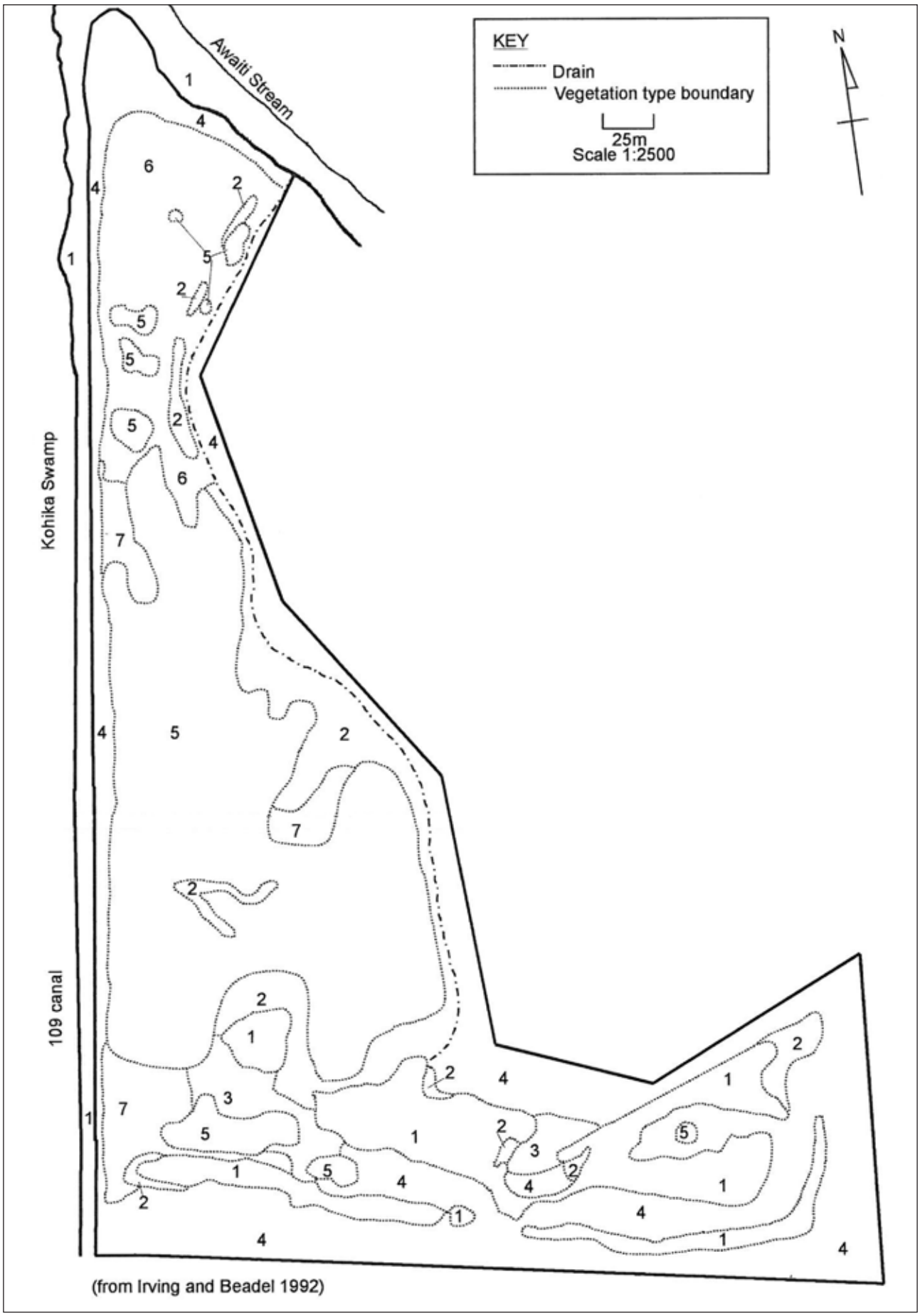




5a: Tarawera Cut Wildlife Management Reserve



5b & 5c: Bregman Wildlife Management Reserve



Tarawera Cut—Bregman

Te Teko Natural Area No. 5 (5a-e)
Grid Reference NZMS260 V15 425590 (5a); NZMS260 V15 436593 (5b & c)
Area 14.36 ha (5a); 8.57 ha (5b & c); 4.11 ha (5e)
Landform Unit Alluvial plain
Status Administered by Department of Conservation (5a & b); Administered by FGNZ (5c)

BIOCLIMATIC ZONE	VEGETATION	LANDFORM
Semi-coastal	**Tarawera Cut Wildlife Management Reserve (5a)**	
	1. Grey willow/*Baumea juncea*-harakeke-*B. rubiginosa* forest.	Wetland
	2. Grey willow/*Carex virgata*-*C. maorica*-raupō-harakeke treeland.	Wetland
	3. (Grey willow)-(mānuka)-(*Coprosma*)-(*Carex*)-(*Baumea*) shrub-sedgeland.	Wetland
	4. Mānuka/(*Carex*) scrub.	Wetland
	5. *Bolboschoenus fluviatilis*-(*Juncus*)-(*Carex*)-(Mercer grass; *Paspalum distichum*) grass-rush-sedgeland.	Wetland
	6. Raupō reedland.	Wetland
	7. Blackberry shrubland.	Wetland
	8. Crack willow treeland.	Wetland
	9. Open water.	Open water
	(Irving 1992c)	
	Bregman Wildlife Management Reserve (5b & c)	
	1. Open water.	Open water
	2. Raupō reedland.	Wetland
	3. *Schoenoplectus tabernaemontani* reedland.	Wetland
	4. Stopbanks and excavation spoil.	Flats
	5. Grey willow/*Coprosma propinqua* subsp. *propinqua* forest.	Wetland
	6. *Cyperus ustulatus*-reed sweetgrass sedge-grassland.	Wetland
	7. Reed sweetgrass grassland.	Wetland
	(Irving 1992d)	

Vegetation Vegetation descriptions are given in Irving (1992c&d).

Flora *Cyclosorus interruptus* and *Thelypteris confluens* (both species classed as 'At Risk-Declining' in de Lange *et al*. 2009) occur in both these reserves.

Fauna Rasch (1989) notes large numbers of waders, including Australasian bittern ('Threatened-Nationally Endangered' in Miskelly *et al*. 2008) and banded dotterel (Threatened-Nationally Vulnerable), fernbird ('At Risk-Declining' in Miskelly *et al*. 2008), and spotless crake ('At Risk-Relict' in Miskelly *et al*. 2008) present at this site.

Discussion These areas are protected, and are separated by the Tarawera River, an area of privately owned wetland (Kohika) and a

canal. Together they contain representative examples of the wetland vegetation of the ecological district. Bregman Wildlife Management Reserve contains one of only five known populations of a rare fern, *Thelypteris confluens*, in the Te Teko Ecological District and Whakatane Ecological Region. This species also occurs in Tarawera Cut Wildlife Management Reserve in low numbers.

Cyclosorus interruptus is locally common in parts of both of these reserves.

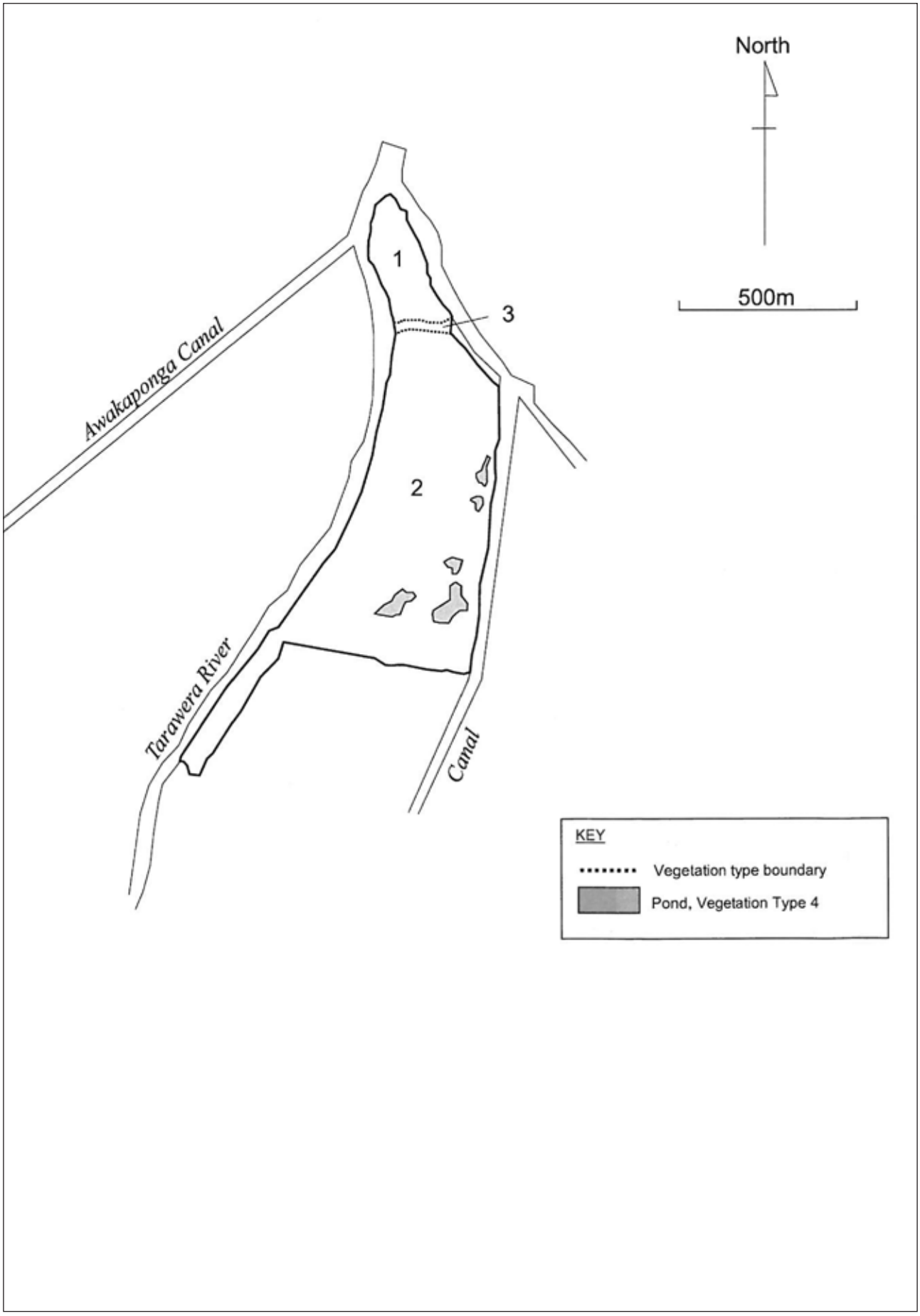
References

Beadel 1992d, 1992e, 1992j, & 1992k; Irving 1992c & 1992d; Miller 1983b & 1983c.

Footnote

The Thelypteris confluens and Cyclosorus interruptus populations in Bregman Wildlife Management Reserve declined dramatically following a rapid increase in the density of reed sweetgrass that occurred when grazing was removed from the site. However, they are now gradually recovering, following control of reed sweetgrass which is being undertaken by DOC.

5d: Kohika Wetland



Kohika (Tarawera Cut–Bregman)

Te Teko Natural Area No.	5d
Grid Reference	NZMS260 V15 433595
Area	44.59 ha
Landform Unit	Wetland
Status	Unprotected
Recommended Area for Protection	Yes

BIOCLIMATIC ZONE	VEGETATION		LANDFORM
Coastal and semi-coastal	1.	Tī kōuka/raupō-harakeke-*Coprosma propinqua* subsp. *propinqua* shrub-flax-reedland; raupō-*Bolboschoenus fluviatilis*/swamp millet sedge-reedland; raupō-*Baumea articulata*/swamp millet reedland.	Wetland
Semi-coastal	2.	Grey willow-crack willow forest and treeland, and ti kouka-grey willow/*Coprosma propinqua* subsp. *propinqua*-*Coprosma tenuicaulis* scrub.	Wetland
	3.	Stopbank-exotic grasses and herbs.	Flat
	4.	Open water.	Ponds, wetland
		(Source: Beadel 1993c)	

Vegetation

The vegetation of Kohika is relatively varied. At the northern end there is ti kouka/raupō-harakeke-*Coprosma propinqua* subsp. *propinqua* shrub-flax-reedland; raupō-*Bolboschoenus fluviatilis*/swamp millet sedge-reedland; raupō-*Baumea articulata*/swamp millet reedland. There are also areas of ti kouka-grey willow/*Coprosma propinqua* subsp. *propinqua*-*Coprosma tenuicaulis* scrub, and several areas of open water.

In the larger southern portion grey willow and crack willow often form a discontinuous canopy with scattered *Coprosma propinqua* subsp. *propinqua* × *Coprosma robusta*, tī kōuka, blackberry, and *Muehlenbeckia australis*; the understorey varies from predominantly indigenous to predominantly naturalised common species including *Carex secta*, *C. maorica*, *C. geminata*, whekī, karamū (*Coprosma robusta*), *Coprosma tenuicaulis*, reed sweetgrass, and forget-me-not (*Myosotis* sp.). *Baumea juncea* is locally abundant.

Flora

Thelypteris confluens and *Cyclosorus interruptus* are present in the eastern area; *C. interruptus* is present in the western area. Both these species are classed as 'At Risk-Declining' in de Lange *et al.* (2009).

Taxa present includes *Myriophyllum propinquum* and *Hypolepis distans*, swamp millet, *Baumea articulata*, and harakeke. *Hypolepis distans* is a regionally uncommon species.

Fauna

Although not recorded during the field inspection, spotless crake ('At Risk-Relict' in Miskelly *et al.* 2008), fernbird ('At Risk-Declining' in Miskelly *et al.* 2008) and Australasian bittern ('Threatened-Nationally Endangered' in Miskelly *et al.* 2008)

occur in the adjoining Tarawera Cut Wildlife Management Reserve and are likely to use this area.

Discussion

Kohika Wetland is ecologically important because it is a relatively large freshwater wetland linking two protected natural areas. It extends over two bioclimatic zones. Its relative significance is highlighted by the large reduction in wetland habitat since 1840, only *c.* 2.4% remains of the vast wetlands (*c.* 27,000 ha) that once covered the Rangitaiki Plains. It is one of the few remaining examples of wetland vegetation in the Te Teko Ecological District. Two at risk plant species are present and it is significant as habitat for wading birds. One threatened species and two at risk fauna species have been recorded from this area. Large numbers of waders also use this site (Rasch 1989).

Kohika Pa, an archaeological site of national significance, extends into this natural heritage site.

References

Beadel 1993c; Rasch 1989.

Footnote

In February 2000 earthworks were carried out, including vegetation clearance and the construction of ponds/open water areas. An assessment of the impacts of this clearance and recommendations for restoration of the site were made by Wildland Consultants Ltd (Beadel and Shaw 2000).

Tarawera Cut Extension

Te Teko Natural Area No.	5e[5]
Grid Reference	NZMS260 V15 424583
Area	4.11 ha
Landform Unit	Wetland
Status	Unprotected
Recommended Area for Protection	Yes

BIOCLIMATIC ZONE	VEGETATION	LANDFORM
Semi-coastal	Grey willow-crack willow treeland (grey willow and crack willow form a discontinuous canopy with scattered *Coprosma propinqua* subsp. *propinqua* × *Coprosma robusta*, tī kōuka, blackberry and Muehlenbeckia australis; the understorey varies from predominantly indigenous to predominantly naturalised species. Common species present include *Carex secta*, *C. maorica*, *C. geminata*, whekī, karamū, *Coprosma tenuicaulis*, reed sweetgrass, and forget-me-not. *Baumea juncea* is locally abundant. (Current survey.)	Wetland

Flora A small colony of *Cyclosorus interruptus* is present (classed as 'At Risk-Declining' in de Lange *et al.* 2009). Other taxa present includes *Myriophyllum propinquum, Hypolepis distans,* swamp millet, *Baumea articulata,* and harakeke. *Hypolepis distans* is a regionally uncommon species.

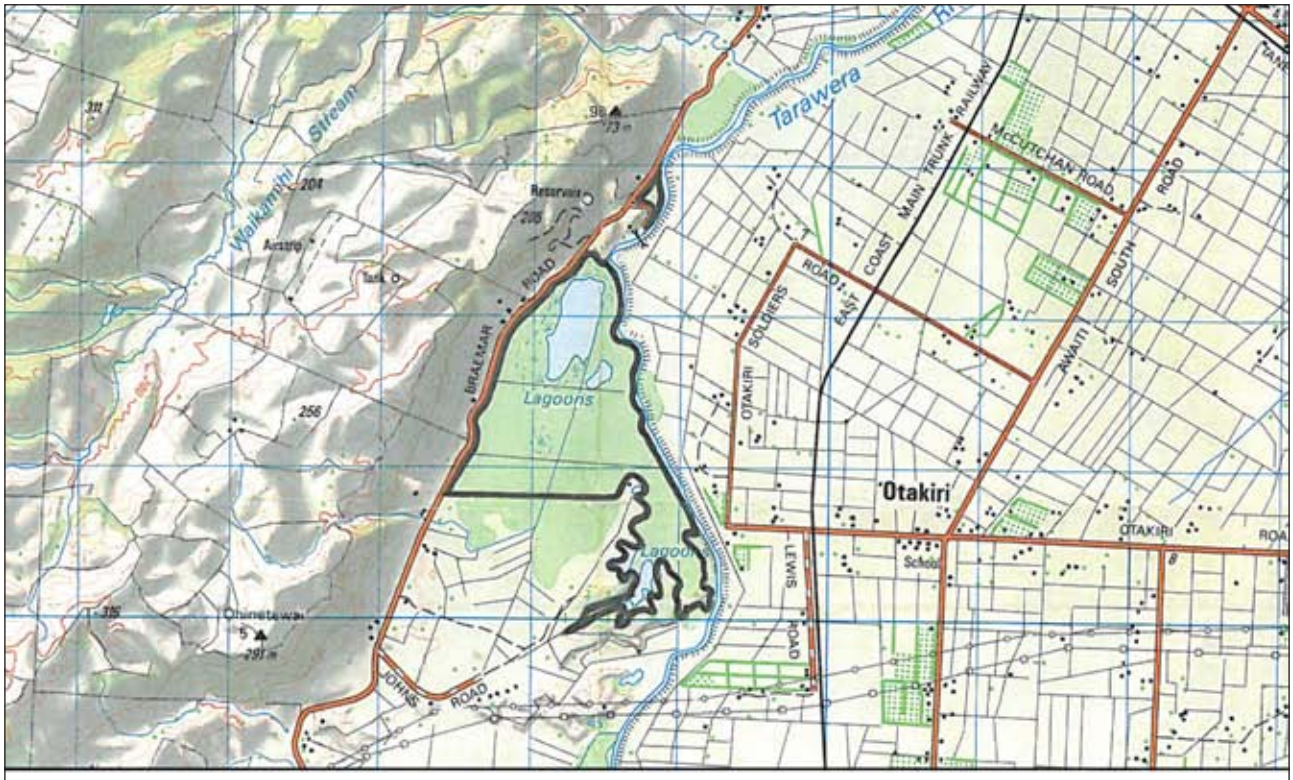
Fauna Although not recorded during the field inspection, spotless crake ('At Risk-Relict' in Miskelly *et al.* 2008), fernbird ('At Risk-Declining' in Miskelly *et al.* 2008) and Australasian bittern ('Threatened-Nationally Endangered' in Miskelly *et al.* 2008) occur in the adjoining Tarawera Cut Wildlife Management Reserve and are likely to use this area.

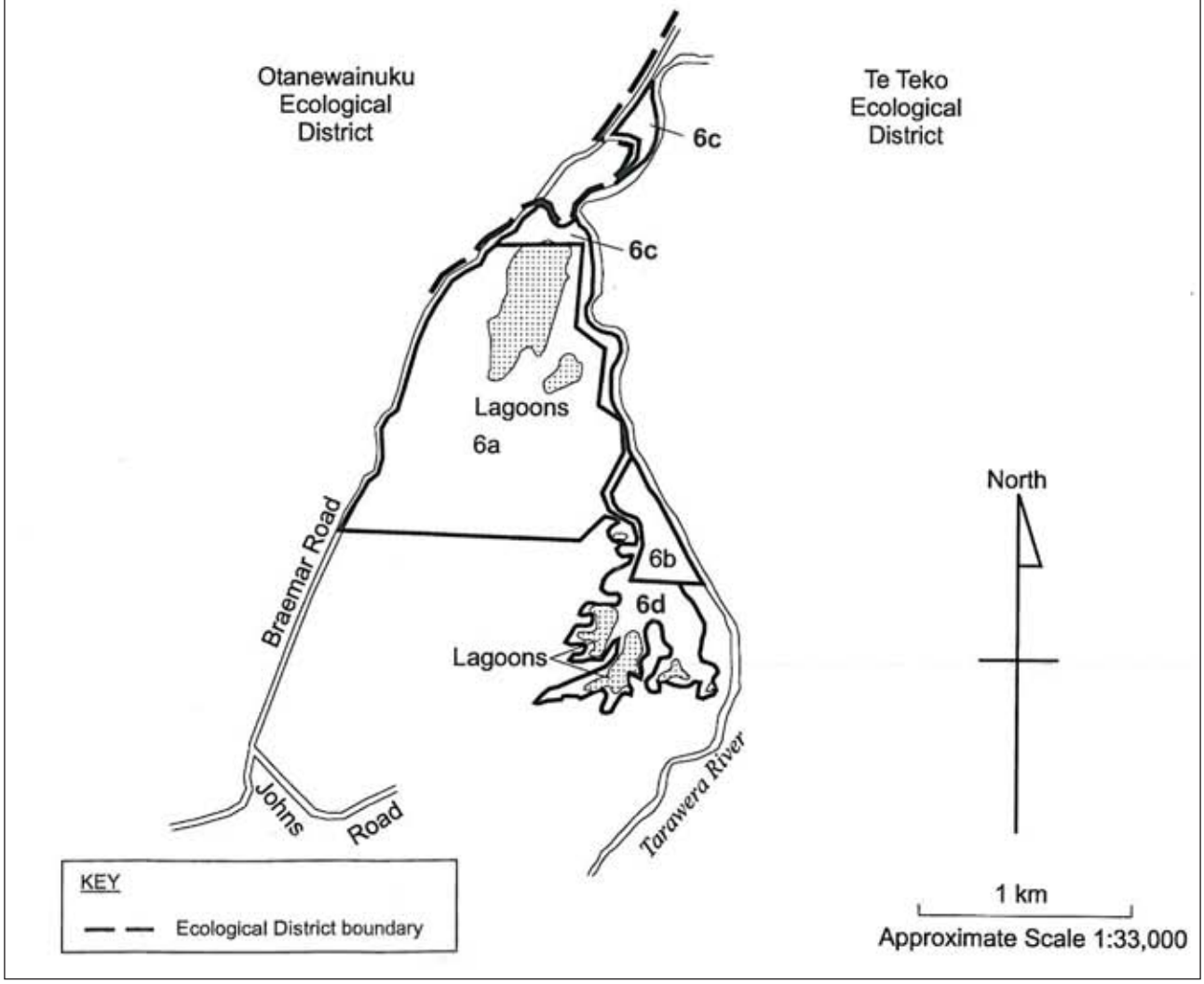
Threat/Modification Modified wetland vegetation; weeds have established following disturbance (clearance, grazing, drainage) of the original vegetation.

Discussion This natural area is part of a relatively large wetland area "Tarawera Cut-Bregman". It contains a small population of a chronically threatened species, and also is suitable habitat for indigenous wetland bird species, including one nationally endangered species. Wetlands once covered much of the Rangitaiki Plains, however since 1840 they have been greatly reduced in extent and now comprise only *c.* 2.4% of their original extent of *c.* 27,000 ha. This highlights the significance of all remaining wetland areas.

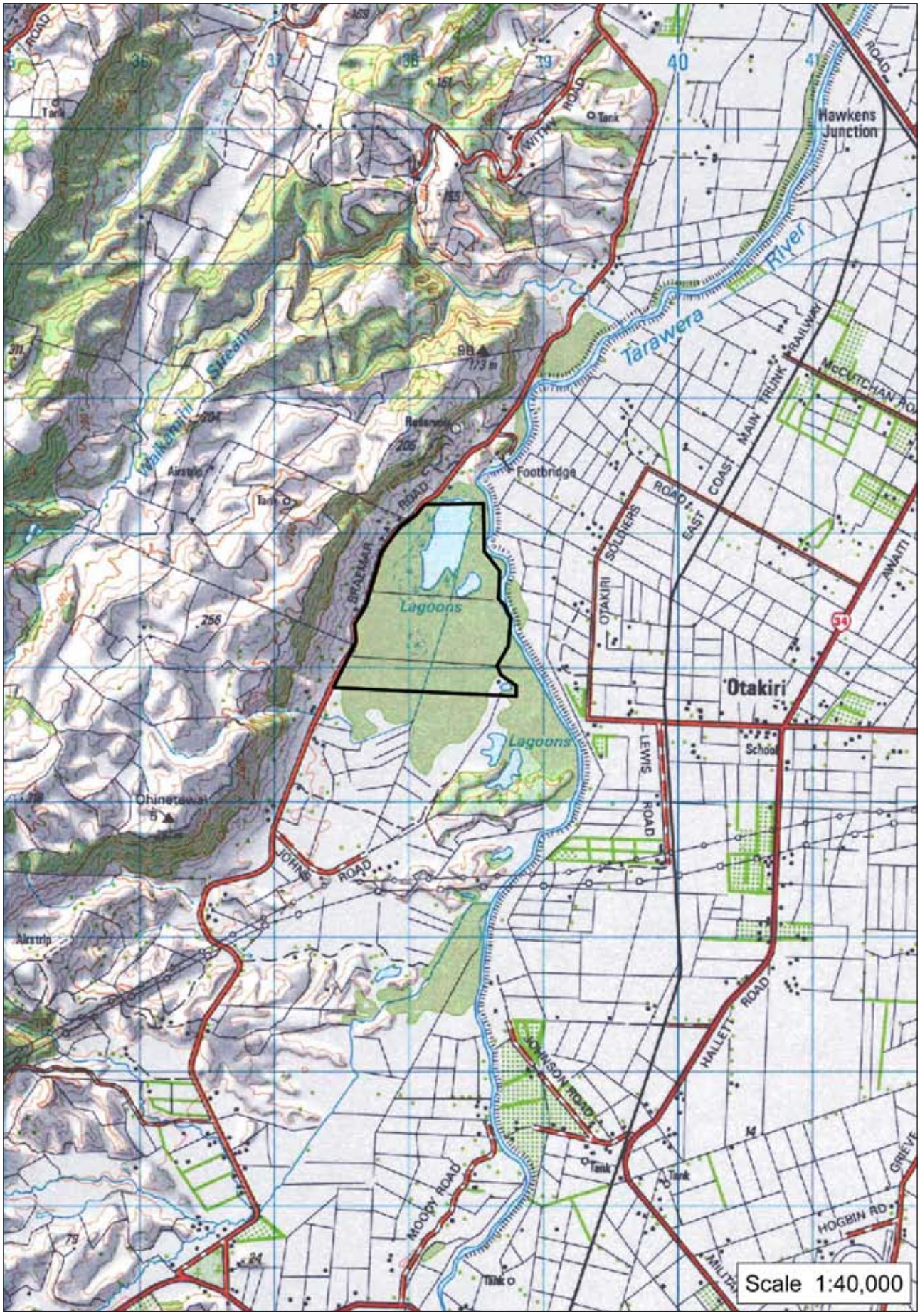
5 Location shown in location map for Natural Area 5 - Tarawera Cut-Bregman.

6 (6a–6d): Tumurau

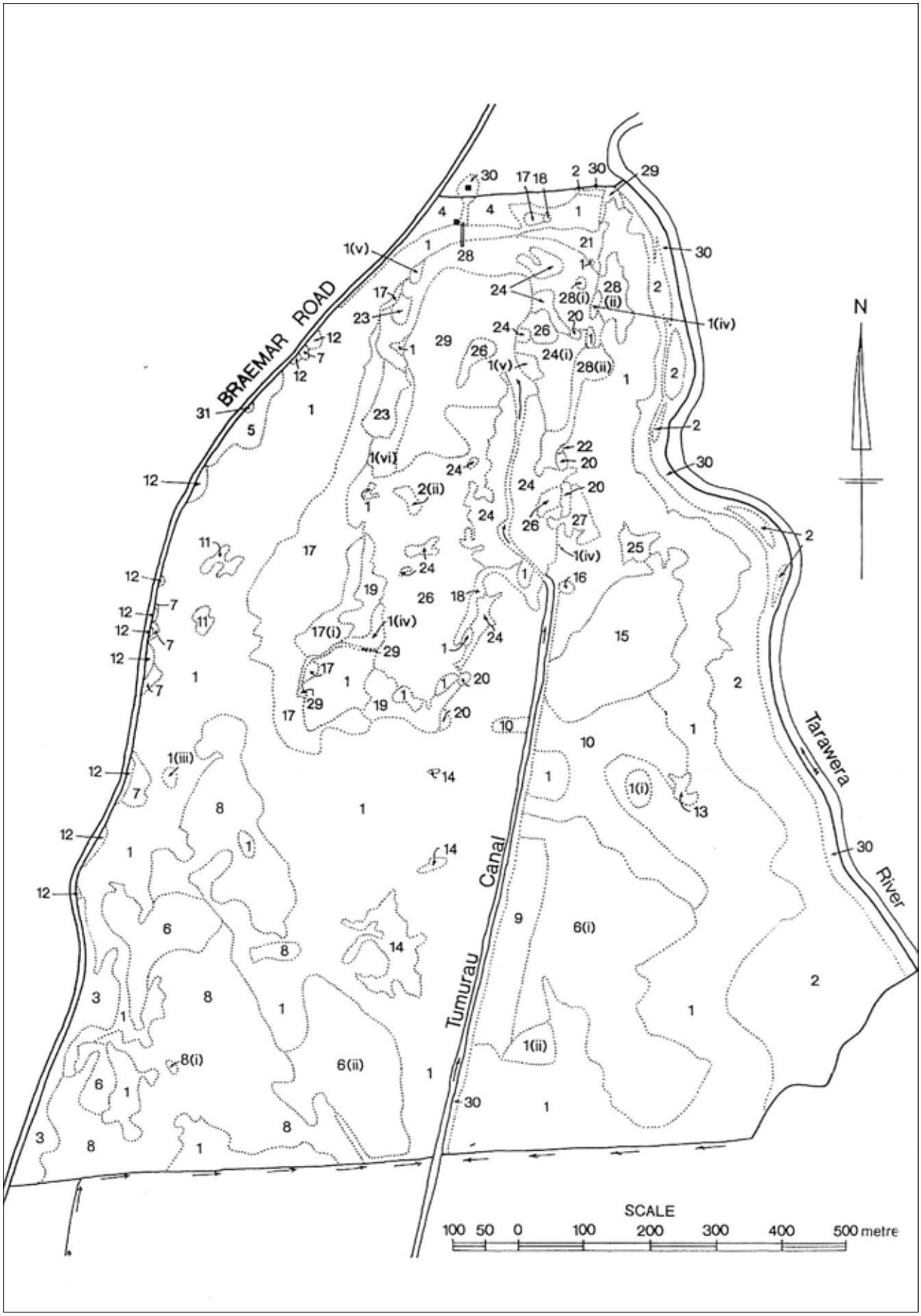




6a: Tumurau Lagoon



6a: Tumurau Lagoon



Tumurau Protective Covenant (Tumurau)[6]

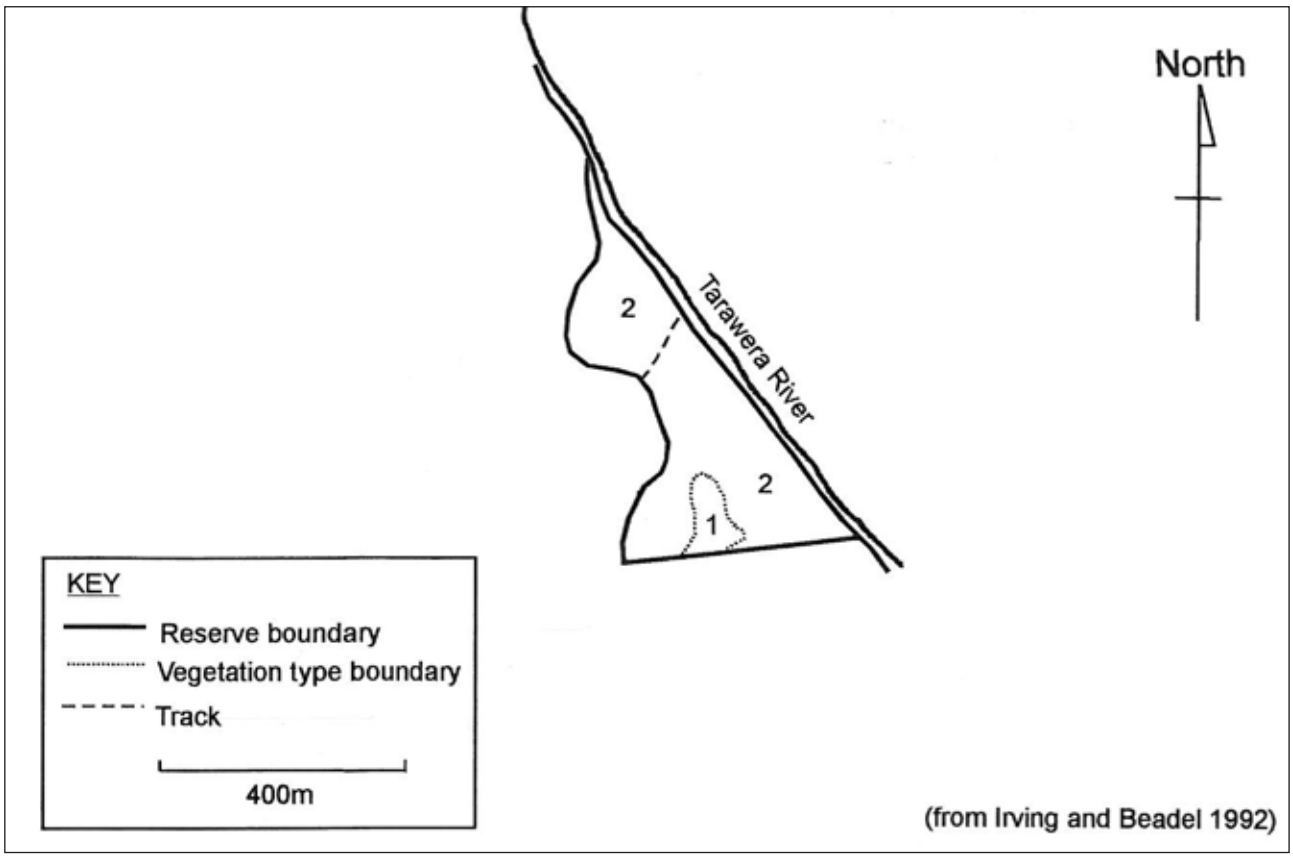
Te Teko Natural Area No. 6a
Grid Reference NZMS260 V15 383514
Area 132.91 ha
Landform Unit Alluvial plain
Status Conservation covenant

BIOCLIMATIC ZONE	VEGETATION	LANDFORM
Semi-coastal	1. Grey willow forest.	Wetland
	2. Grey willow/privet (*Ligustrum sinense*) forest and scrub.	Wetland
	3. Radiata pine (*Pinus radiata*)/black wattle (*Acacia mearnsii*)/privet forest.	Flat
	4. Tī kōuka/māhoe (*Melicytus ramiflorus* subsp. *ramiflorus*)-privet-mamaku-*Coprosma propinqua* subsp. *propinqua*-mānuka/bracken treeland.	Flat
	5. Yunnan poplar (*Populus yunnanensis*)-black wattle-grey willow treeland.	Wetland
	6. Mānuka scrub.	Wetland
	7. (Tī kōuka)/*Coprosma propinqua* subsp. *propinqua*/*Baumea-Gleichenia microphylla* shrubland.	Wetland
	8. Grey willow/mānuka scrub Û Grey willow/mānuka/wirerush shrubland.	Wetland
	9. (Dead grey willow)/mānuka/*Baumea*-harakeke shrubland.	Wetland
	10. Grey willow-mānuka-(ti kouka)/harakeke-*Coprosma propinqua* shrubland.	Wetland
	11. Mānuka/*Baumea*-harakeke shrubland.	Wetland
	12. Bracken fernland.	Flat
	13. (Mānuka)-(grey willow)/*Baumea*-spike sedge (*Eleocharis acuta*)-*Juncus*-swamp millet grass-shrub-rush-sedgeland.	Wetland
	14. (Raupō)/spike sedge-*Carex maorica-Carex secta* sedgeland.	Wetland
	15. (Raupō)/*Juncus* rushland and raupō reedland.	Wetland
	16. Raupō/*Carex virgata-C. secta*-swamp millet sedge-grassland.	Wetland
	17. Swamp millet grassland.	Wetland
	18. Reed sweetgrass grassland and *Persicaria decipiens* herbfield.	Wetland
	19. Grey willow/*Carex virgata-C. maorica*-spike sedge tree-sedgeland	Wetland
	20. Raupō reedland	Wetland
	21. Raupō reedland and waterfield	Wetland
	22. Baumea articulata reedland	Wetland
	23. Persicaria decipiens-Juncus-spearwort (*Ranunculus flammula*) herbfield	Wetland
	24. Persicaria decipiens herbfield	Wetland
	25. (Harakeke)/swamp millet grassland and raupō waterfield	Wetland
	26. Persicaria decipiens waterfield	Wetland
	27. Swamp millet-*Juncus-Persicaria decipiens* waterfield.	Wetland
	28. Raupō-*Juncus* waterfield.	Wetland
	29. Open water.	Open water
	30. Stopbanks, tracks and canal margins.	Flat

6 Contiguous with 6b, 6c and 6d.

Vegetation	Tumurau can be divided into three sections - north, south and margins. The northern section comprises the Tumurau lagoon and associated vegetation, and surrounding grey willow forest. The southern section comprises grey willow forest, and mānuka scrub, shrublands and sedgelands. The vegetation along the western and eastern margins of the covenant is characterised by the dominance of naturalised species (Beadel 1992a).
Flora	*Thelypteris confluens* and *Cyclosorus interruptus* occur in the wetlands. These are 'At Risk' species classed as 'Declining' in de Lange *et al.* (2009). *Utricularia australis* (classed as 'Threatened-Naturally Endangered' in de Lange *et al.* 2009) was recorded from the lagoon in 1963, however, despite searching it has not been recorded recently. Three regionally uncommon species occur in the wetlands: wire rush (*Empodisma minus*), *Sparganium subglobossum, Nertera scapanioides*, and *Epilobium chionanthum* (Beadel 1992a).
Fauna	New Zealand dabchick (Threatened-Nationally Vulnerable), North Island fernbird ('At Risk-Declining' in Miskelly *et al.* 2008), New Zealand shoveller, and New Zealand scaup are present. Rasch (1989) recorded spotless crake ('At Risk-Relict' in Miskelly *et al.* 2008). Tumurau Lagoon is a paradise shelduck moulting site (Rasch 1989).
Discussion	This site contains the best quality and largest representative example of wetland vegetation remaining in the Te Teko Ecological District. It contains the largest population of *Cyclosorus interruptus* in the Ecological District.
References	Beadel 1992a; Rasch 1989.
Footnote	Vegetation changes in the wetland between the years 1992 and 1998 were assessed in 1998 (see Beadel and Shaw 1998).

6b: Matuku Wildlife Management Reserve



Matuku Wildlife Management Reserve (Tumurau)

Te Teko Natural Area No. 6b
Grid Reference NZMS260 V15 389508
Area 11.62 ha
Landform Unit Wetland (former oxbow of Tarawera River)
Status Managed by FGNZ

BIOCLIMATIC ZONE	VEGETATION	LANDFORM
Semi-coastal	1. Grey willow/(*Coprosma* spp.)-harakeke shrubland.	Open water, flat.
	2. Privet-Japanese honeysuckle (*Lonicera japonica*)-barberry (*Berberis glaucocarpa*) shrubland.	Flat

Vegetation Extensive drainage of surrounding land and the characteristic of the Tarawera River has markedly affected the water levels within this reserve. They are now mostly well below substrate level. This has caused degradation of the original wetland vegetation with replacement of indigenous species by exotic dryland weeds.

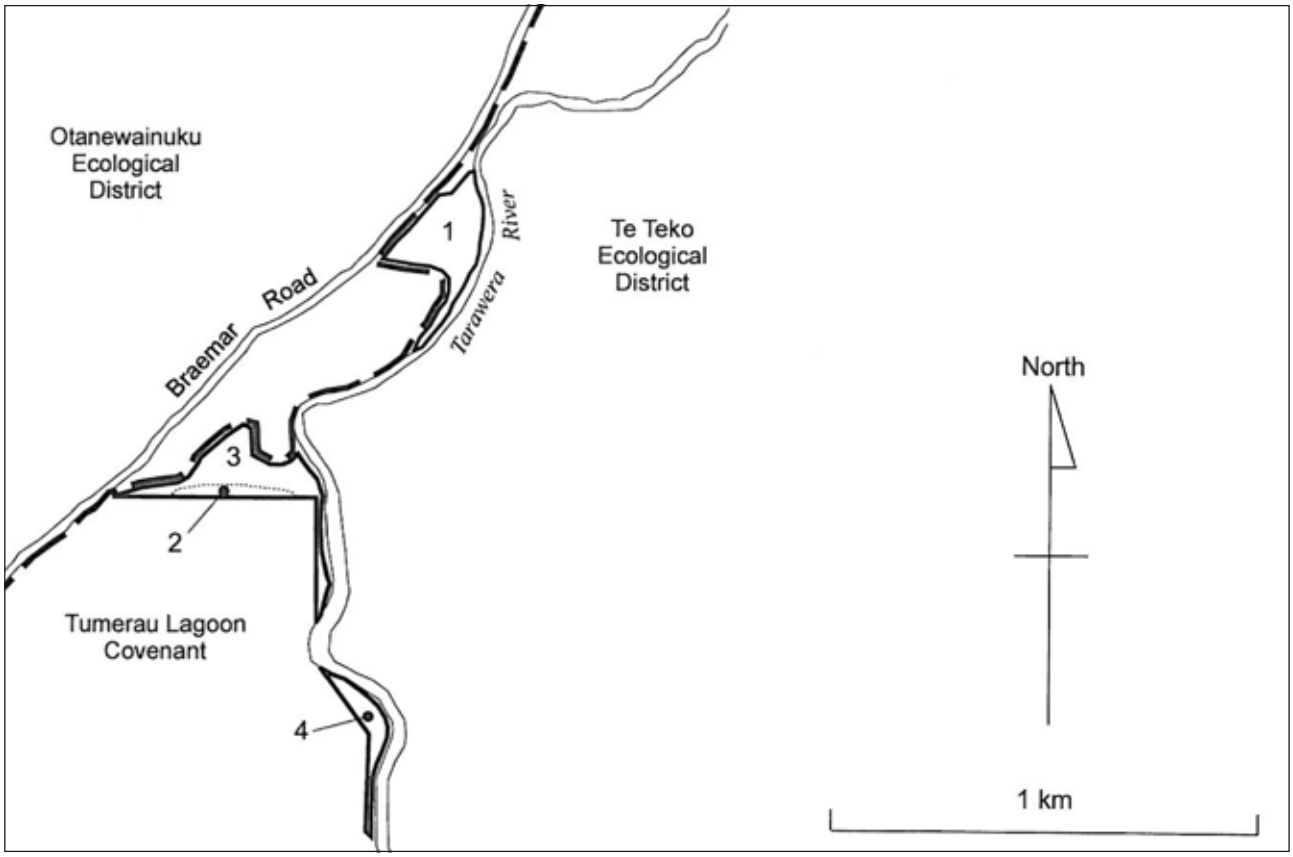
Flora No significant species are present in this reserve.

Fauna Dabchick (Threatened-Nationally Vulnerable), fernbird ('At Risk-Declining' in Miskelly *et al*. 2008) (Miskelly *et al*. 2008), and spotless crake ('At Risk-Relict' in Miskelly *et al*. 2008) have been reported and the site is used as a moulting areas for paradise shelduck (W. Price pers. comm.).

Threats/Modification Weeds are very prevalent in the reserve. The reserve was grazed when inspected in 1991.

Discussion This reserve is largely dominated by naturalised species and no features of conservation significance were recorded during the 1991 survey (Irving and Beadel 1992).

6c: Tumurau North



Tumurau North (Tumurau)

Te Teko Natural Area No. 6c[7]

Grid Reference NZMS V15 387528

Area 3.64 ha

Landform Unit Alluvial plain

Status Unprotected

Recommended Area for Protection Yes

BIOCLIMATIC ZONE	VEGETATION	LANDFORM
Semi-coastal	1. Grey willow-*Coprosma propinqua* subsp. *propinqua*-mānuka forest	Wetland
	2. Open water	Lagoon
	3. Grey willow forest.	Wetland
	4. Grey willow/privet forest.	Flood plain

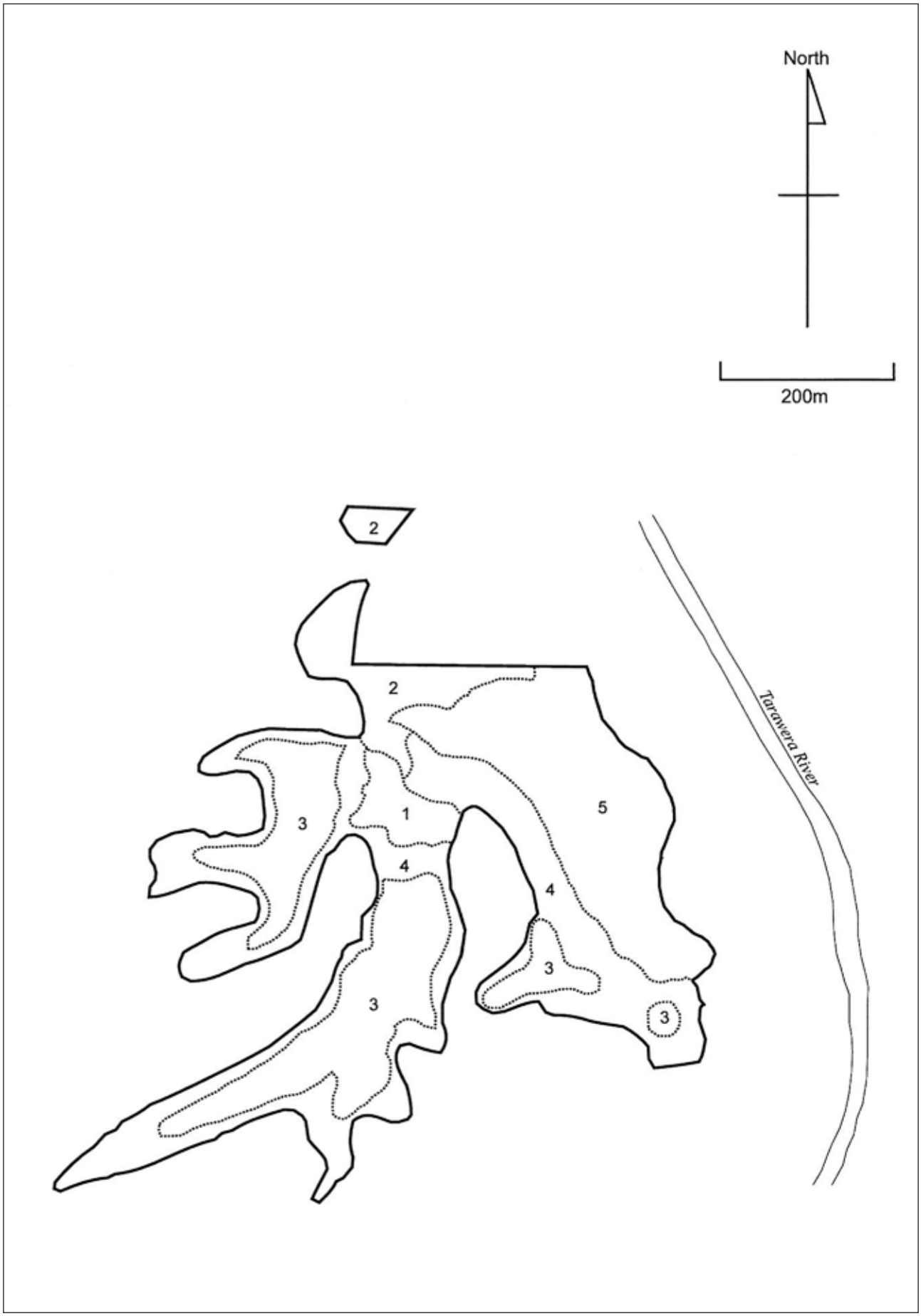
Vegetation Grey willow forest, with common *Coprosma propinqua* subsp. *propinqua* and mānuka, and scattered tī kōuka, is the dominant vegetation on the flood plain. Swamp millet and *Baumea articulata* with occasional swamp kiokio (*Blechnum minus*), and local *Schoenoplectus tabernaemontani, Baumea arthrophylla, Baumea tenax, Carex secta* and raupō form the understorey.

Flora and Fauna No significant species were recorded during this survey, however the site contains suitable habitat for marsh birds.

Discussion This site is contiguous with Tumurau Lagoon and provides a valuable buffer to this important wetland of significant conservation value which is the largest remaining example of indigenous wetland vegetation in the Te Teko Ecological District. It forms part of a network of habitat islands facilitating the dispersal of wildlife species between the Te Teko and Otanewainuku Ecological Districts. This site is part of a natural heritage area that extends into Otanewainuku ecological district (see Tumurau extension, Beadel *et al.* 1996b).

7 Location shown in location map for Natural Area 6 - Tumurau.

6d: Young Wetlands



Young Wetlands (Tumurau)

Te Teko Natural Area No. 6d
Grid Reference NZMS260 V15 390505
Area 26.30 ha
Landform Unit Wetland
Status Unprotected
Recommended Area for Protection Yes

BIOCLIMATIC ZONE	VEGETATION	LANDFORM
Semi-coastal	1. Grey willow/mānuka forest.	Wetland
	2. Grey willow forest.	Wetland
	3. Open water.	Open water
	4. Grey willow and raupō reedland and sedgeland.	Wetland
	5. Willow canopy and crack willow/privet forest and scrub.	Wetland and flat
	(Beadel 1994b)	

Vegetation Map Beadel (1994b).

Vegetation See Beadel (1994b).

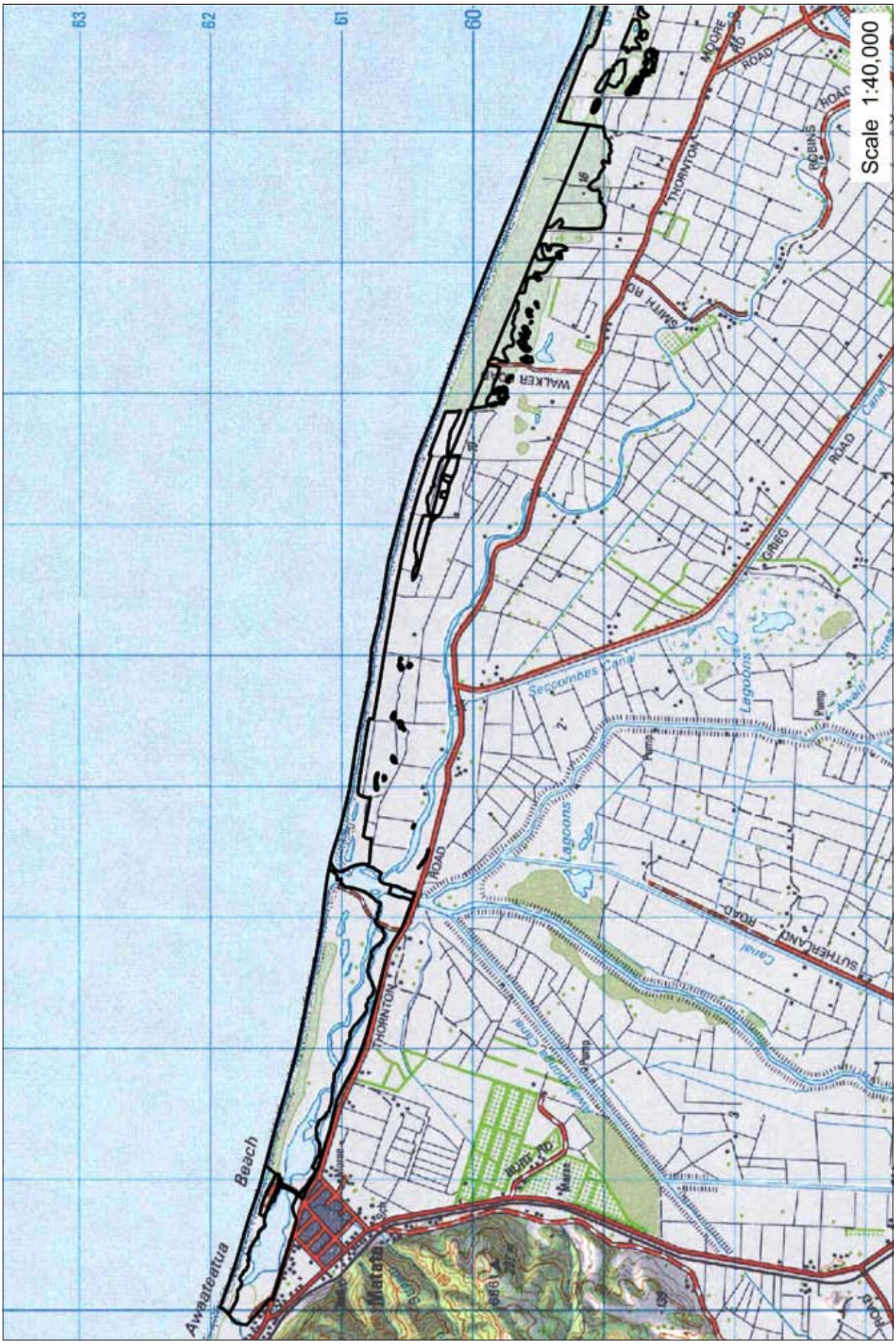
Flora *Thelypteris confluens* and *Cyclosorus interruptus* are present in this site. These species are classed as 'At Risk-Declining' in de Lange *et al.* (2009).

Fauna There is no existing information available on fauna, however the wetland contains suitable habitat for several threatened or uncommon species, including Australasian bittern, fernbird ('At Risk-Declining' in Miskelly *et al.* 2008), and spotless crake ('At Risk-Relict' in Miskelly *et al.* 2008).

Discussion This site is part of a relatively large wetland complex which includes Tumurau Lagoon and Matuku. The Young Wetlands contain some of the best known populations of *Cyclosorus interruptus* and *Thelypteris confluens* in the Te Teko Ecological District. Despite drainage of the surrounding farmland, the wetland vegetation has maintained a significant indigenous component.

References Beadel 1994b.

7 (7a–7k): Sheet 1of 3 Matata–Whakatane Dunes

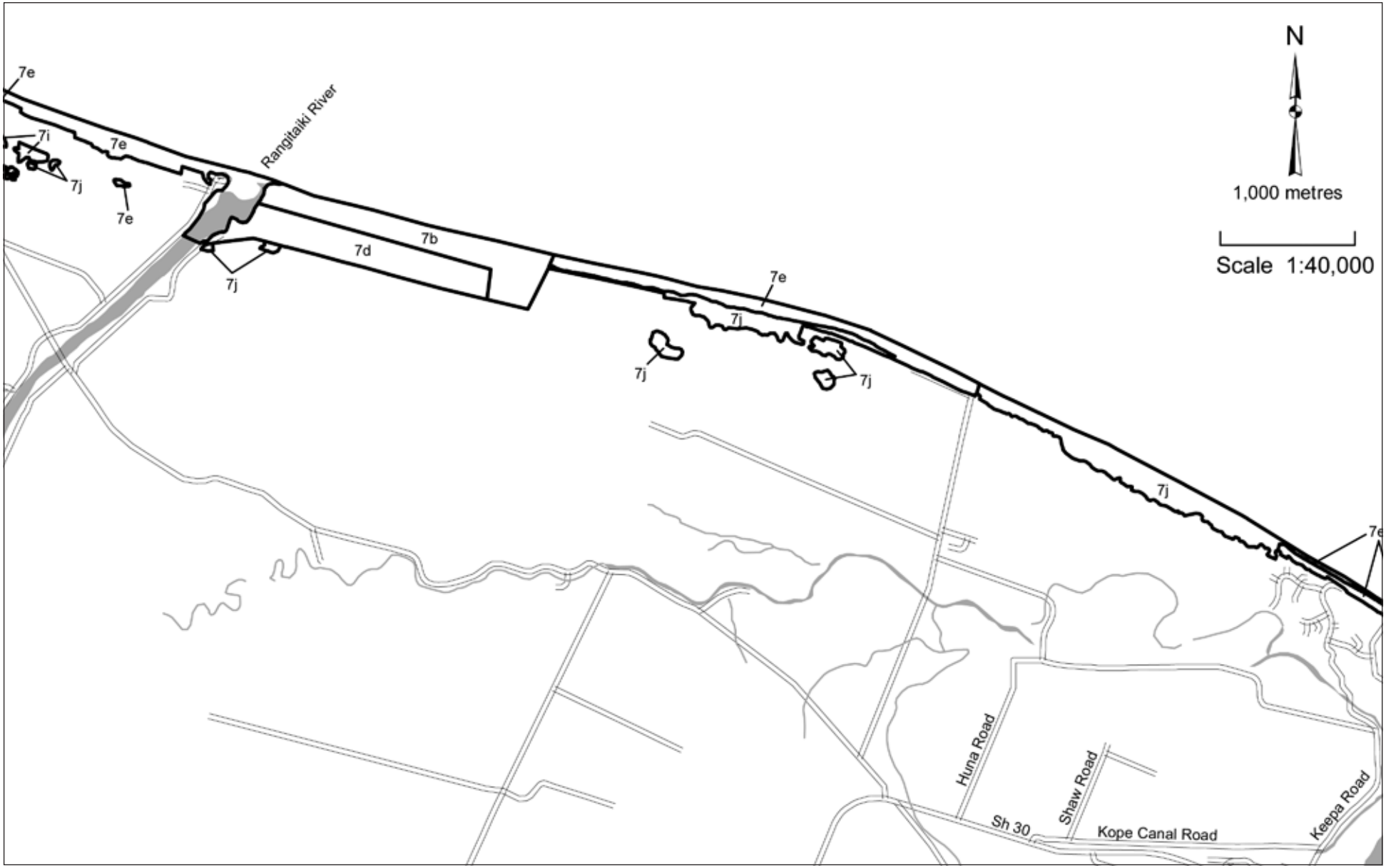


7 (7a–7k): Sheet 2of 3 Matata–Whakatane Dunes

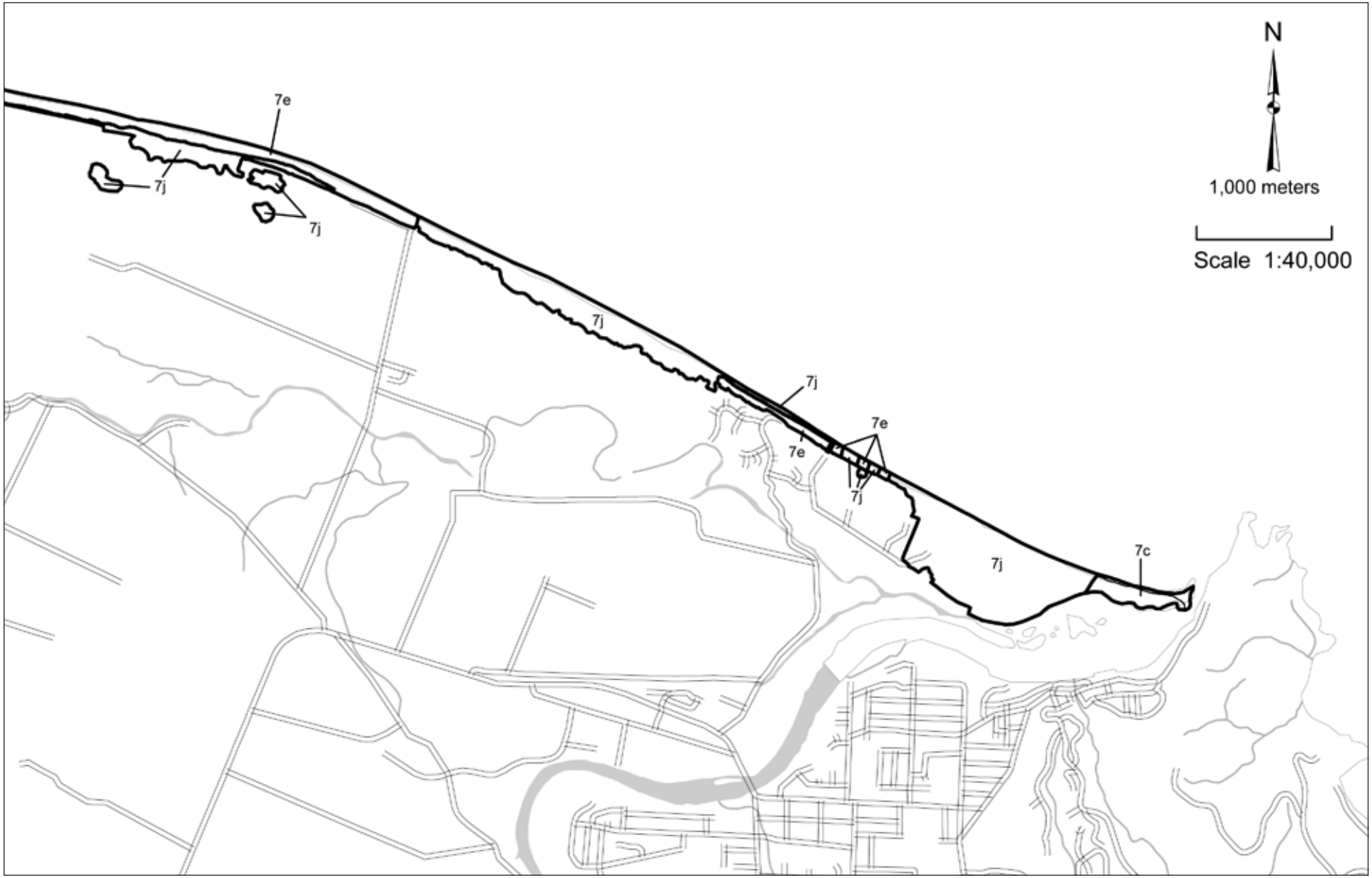
7 (7a–7k): Sheet 3of 3 Matata–Whakatane Dunes

7 (7a–7k): Sheet 1of 3 Matata–Whakatane Dunes

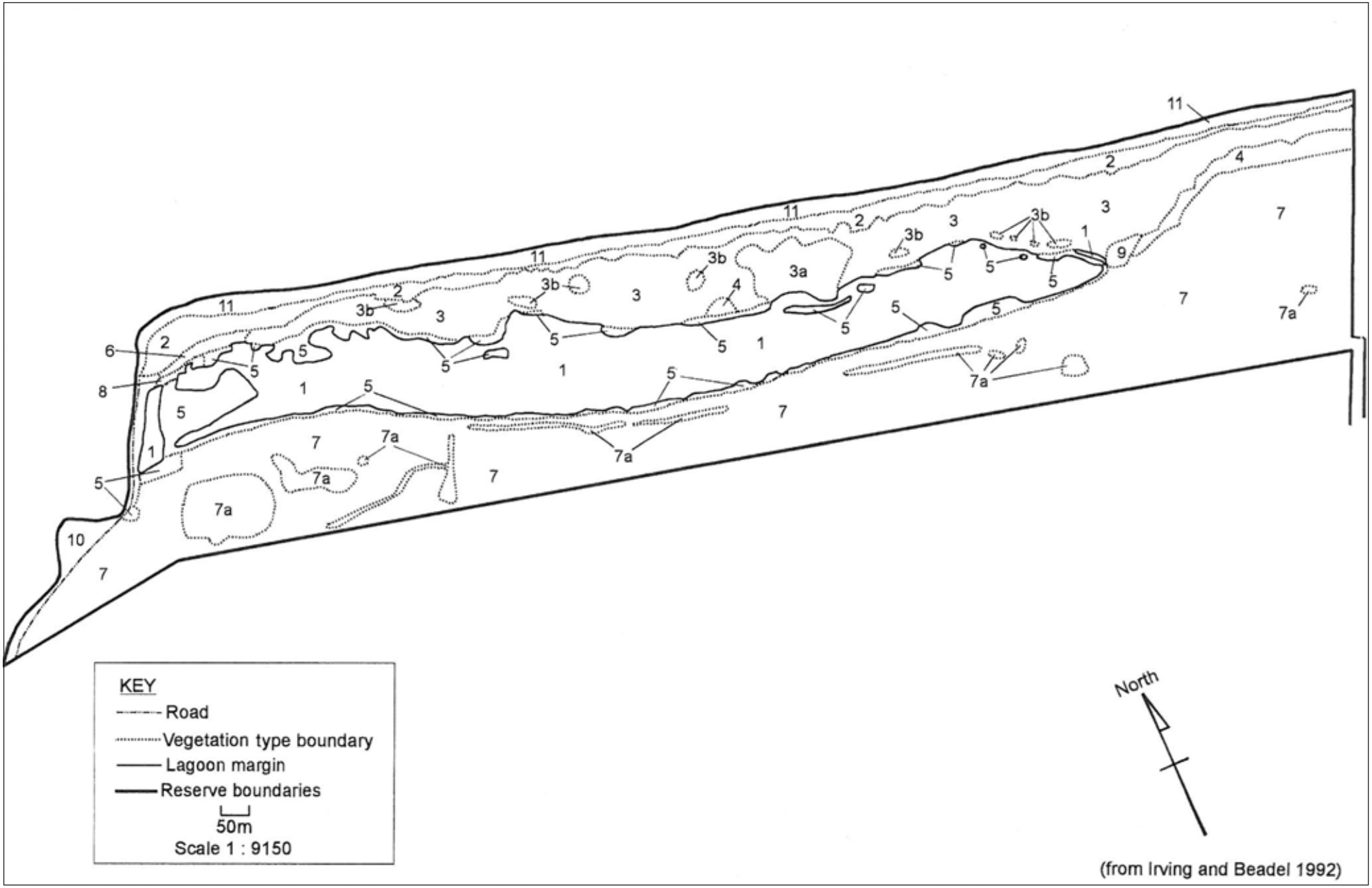
7 (7a–7k): Sheet 2 of 3 Matata–Whakatane Dunes



7 (7a–7k): Sheet 3 of 3 Matata–Whakatane Dunes



7b: Thornton Lagoon wildlife Management Reserve



Matata–Whakatane Dunes

Te Teko Natural Area No.	7 (7a-7l)
Grid Reference (Central)	NZMS260 V15 421611 (7a); W15 525582 (7b); W15 621543 (7c); W15 521581 (7d); V15 475599 (7e); V15 405617 (7f); V15 4922608 (7g); V15 463602 (7h); V15 497588 (7i); W15 610544 (7j); V15 432605 (7k); V15 434604 (7l)
Area	114.65 ha (7a); 49.25 ha (7b); 9.81 ha (7c); 48.04 ha (7d); 194.28 ha (7e); 10.11 ha (7f); 27.54 ha (7g); 2.89 ha (7h); 5.57 ha (7i); 180.13 ha (7j); 1.17 ha (7k); 0.04 ha (7l)
Landform Unit	Sand dunes, estuarine channel, lakes/ponds, ocean beach, wetland, alluvial plain
Status	Administered by DOC (174.92 ha); Covenant over private land (8.46 ha); Administered by Fish and Game (48.04 ha); Administered by Whakatane District Council (204.39 ha); Unprotected (207.67 ha).
Recommended Areas for Protection	7e, 7f, 7g, 7j

General

This site is part of a larger natural area that extends west to Otamarakau (in the Otanewainuku Ecological District) and was identified as a significant natural heritage area in Beadel et al. 1996b&c and in Wildland Consultants 2006c & 2007b.

This site incorporates areas of several Department of Conservation administered protected areas (Piripai Spit Conservation Area), (Matata Wildlife Refuge, Matata Wildlife Refuge Reserve); areas managed jointly with New Zealand Fish and Game; Thornton Lagoon Wildlife Management Reserve; Whakatane District Council; recreation reserves; and covenants and areas of private land.

BIOCLIMATIC ZONE	VEGETATION		LANDFORM
Coastal	**Matata Wildlife Refuge Reserve (7a), Matata Recreation Reserve (7f), Matata Wildlife Refuge (7g), Old Rangitaiki Stewardship Area (Old Rangitaiki River Channel) (7k)**		
	PL[1]	Marsh ribbonwood shrubland.	Wetland
	J	Sea rush-oioi tussockland.	Wetland
	F	(Harakeke)/sea rush-oioi-*Baumea juncea* tussock-sedgeland.	Wetland
	R	Raupō reedland.	Wetland
	H	Bachelor's button-*Sellieria radicans-Elatine gratioloides-Apium prostratum-Isolepis cernua*-arrow grass herbfield.	Wetland
	W	(Grey willow)/*Baumea juncea* treeland.	Wetland
	Sr	Reed sweetgrassland.	Wetland
	M	(African boxthorn)/*Muehlenbeckia complexa*-sea couch-harestail (*Lagurus ovatus*)-catsear (*Hypochoeris radicata*) grass-vineland.	Dune and beach sands
	S	Sand; Spinifex-(pīngao) tussockland; Spinifex sandfield and tussockland.	Dune and beach sands
	Go	Gorse (*Ulex europaeus*)-pampas-blackberry shrubland.	Dune and beach sands
	L	Japanese honeysuckle-tall fescue-pampas grassland and vineland.	Dune and beach sands

6. Map reproduced from Irving 1992b.

BIOCLIMATIC ZONE	VEGETATION	LANDFORM
	C *Carex geminata* sedgeland.	Wetland
	G Grassland, road verges and disturbed areas.	Flat
	Open water.	Lagoon
	(Irving 1992b)	
Coastal	**Thornton Lagoon Wildlife Management Reserve (7b administered by DOC & 7d administered by Fish and Game)**	Dune and beach sands
	1. Open water.	Dune and beach sands
	2. Spinifex-pīngao tussockland.	Dune and beach sands
	3. *Carex pumila*/catsear-harestail sedge-grass-herbfield and *Muehlenbeckia complexa* vineland (3a Marram grass (*Ammophila arenaria*) common; 3b pampas common)	Dune and beach sands
	4. (African boxthorn)/*Muehlenbeckia complexa* vineland.	Dune and beach sands
	5. Raupō reedland.	Open water
	6. *Carex pumila* sedgeland.	Dune and beach sands
	7. *Muehlenbeckia complexa* vineland ⇔ bracken fernland ⇔ bracken/rough pasture ⇔ rough pasture 7(i) Exotic trees 7(ii) Dune and beach sands, exotic tree plantations occur within this area.	Dune and beach sands
	8. Kikuyu (*Pennisetum clandestinum*) grassland.	Dune and beach sands
	9. Crack willow/reed sweetgrassland.	Wetland
	10. Grey willow/*Cyperus ustulatus-Carex geminata* agg. sedgeland and rough pasture.	Wetland; dune and beach sands
	11. Sand.	Dune and beach sands
	(Beadel 1992f)	
Coastal	**Piripai Spit Conservation Area (7c)**	
	• Spinifex-marram sandfield.	Dune and beach sands
Coastal	**Whakatane Coastal Recreation Reserves (7e)**	
	• Thornton kānuka-(African boxthorn)-(akeake (*Dodonaea viscosa*)) forest.	Dune and beach sands
	• Thornton kānuka-(African boxthorn) forest.	Dune and beach sands
	• Dead Thornton kānuka -African boxthorn-(kānuka) treeland.	Dune and beach sands
	• (African boxthorn)/*Muehlenbeckia complexa-Ficinia nodosa-Calystegia soldanella* vineland.	Dune and beach sands
	• Thornton kānuka-(African boxthorn) treeland	Dune and beach sands
	• (African boxthorn)/Indian doab (*Cynodon dactylis*)-ratstail (*Sporobolus africanus*)-yarrow (*Achillea millefolium*) grassland.	Dune and beach sands
	• (Grey willow)/Mercer grass-*Juncus edgariae* grassland.	Wetland
	• (African boxthorn)/spinifex-(pīngao)-(*Muehlenbeckia complexa*) grassland	Dune and beach sands
	• (Grey willow)-(crack willow)/*Eleocharis acuta* sedgeland.	Wetland
Coastal	**Whakatane Conservation Covenants (7h)**	
	• Thornton kānuka forest and treeland.	Dune and beach sands
	• Indian doab (*Cynodon dactylis*)-ratstail (*Sporobolus africanus*)-yarrow (*Achillea millefolium*) grassland.	Dune and beach sands

BIOCLIMATIC ZONE	VEGETATION	LANDFORM
Coastal	**Whakatane Conservation Covenants (7i)**	
	• Thornton kānuka treeland and forest.	Dune and beach sands
	• (Afrian boxthorn)/*Muehlenbeckia complexa-Ficinia nodosa-Calystegia soldanella* vineland.	Dune and beach sands
	• Tī kōuka/kānuka-tree lucerne-grey willow treeland.	Dune and beach sands
	• *Muehlenbeckia complexa*-rarahu-cocksfoot-brome-African boxthorn fern-vineland.	Dune and beach sands
	• *Microlaena stipoides*-brome-cocksfoot grassland	Dune and beach sands
	• Open water.	Pond
Coastal	**Unprotected Areas (7j)**	
	• Sea rush tussockland	Wetland
	• *Baumea juncea* sedgeland	Wetland
	• *Bolboschoenus fluviatilis* sedgeland	Wetland
	• *Baumea articulata-Bolboschoenus fluviatilis*-raupō reedland	Wetland
	• Pampas-harakeke/raupō-*Baumea articulata-Schoenoplectus tabernaemontani-Persicaria decipiens* reedland	Wetland
	• Raupō reedland	Wetland
	• Bachelor's button herbfield	Wetland
	• Thornton kānuka-(African boxthorn)-(akeake) forest	Dune and beach sands
	• Thornton kānuka-(African boxthorn) forest	Dune and beach sands
	• (Tī kōuka)/*Juncus edgariae-Juncus effusus* tussockland	Dune and beach sands
	• Thornton kānuka-(African boxthorn) treeland	Dune and beach sands
	• Sandfield	Dune and beach sands
	• Grey willow/Mercer grass-*Juncus effusus*-beggars' ticks (*Bidens frondosa*) forest	Wetland
	• Open water	Ponds
	• (African boxthorn)/Indian doab-ratstail-yarrow grassland	Dune and beach sands
	• (African boxthorn)/(sweet briar; *Rosa rubiginosa*)/kikuyu grassland	Dune and beach sands
	• (Grey willow)/*Juncus effusus*-Mercer grass-*Baumea articulata* grass reedland	Wetland
	• Marram grassland.	Dune and beach sands
	• Kikuyu grassland.	Dune and beach sands
	• Pasture.	Dune and beach sands
	• River.	River
	(Beadel 1994a, Gosling and Beadel 2000a, Wildland Consultants 2007b, current survey)	
Coastal	**Conservation Area (Matata-Whakatane Dunes) 7l**	
	• Thornton kānuka shrubland	Sand dune

Vegetation

Low sand dune vegetation and sand dune forests modified by fire, grazing, and clearance.

Flora

Thornton kānuka is only known to occur along the coast from Tarawera River to Whakatane River, and also on Whangakopikopiko Island in Taneatua Ecological District. It is classed as 'Taxonomically Indeterminate-Threatened-Nationally Vulnerable' in de Lange *et al.* (2009).

Cyclosorus interruptus (classed as 'At Risk-Declining' in de Lange *et al.* 2009) has been recorded from several sites in Matata Wildlife Refuge.

Pīngao (classed as 'At Risk-Relict' in de Lange *et al.* 2009) is locally common on the dunes.

There is a small population of *Coprosma acerosa* (classed as At Risk-Declining in de Lange *et al.* 2009).

Tetragonia tetragonioides (classed as 'At Risk-Naturally Uncommon') occurs near the Tarawera River Mouth. *Korthalsella salicornioides*, also classed as 'At Risk-Naturally Uncommon', occurs on the Piripai Spit (P. Cashmore pers. comm.).

Three regionally threatened species are present—*Melicytus novae-zelandiae*, *Oxalis rubens*, and *Parietaria debilis*. Another regionally threatened species, *Suaeda novae-zelandiae*, was recorded in 1991 at Matata but has not been seen since.

Other species present include tauhinu (*Ozothamnus leptophylla*).

Fauna

The diverse range of species present includes white heron (Threatened-Nationally Critical), reef heron (a chronically threatened species classed as nationally endangered), Australasian bittern ('Threatened-Nationally Endangered' in Miskelly *et al.* 2008), dabchick ('Threatened-Nationally Vulnerable'); fernbird ('At Risk-Declining' in Miskelly *et al.* 2008), spotless crake ('At Risk-Relict' in Miskelly *et al.* 2008) and banded rail ('At Risk-Naturally Uncommon') (Rasch 1989, Wildland Consultants 2001d).

Banded dotterel (Threatened-Nationally Vulnerable) and variable oystercatcher breed and attempt to breed on the sand dunes along the coast.

Threats/Modification

Grazing

Parts of this area have been retired from grazing over the last 12 years, however some areas are still grazed and grazing animals should be excluded from these areas.

Vehicles

Vehicles access the dune system in several places and utilise an informal track which extends along much of the dune system. Vehicles damage the dune vegetation which can contribute to "blow-outs" in the dunes.

Subdivision

Subdivision of the Thornton kānuka stands is fragmenting these areas, with subsequent impacts of increased disturbance, clearance and weed establishment around margins.

Wildfires

The vegetation throughout this site is highly susceptible to fire, particularly the areas of Thornton kānuka forest. Parts of the Thornton kānuka forest west of Walker Road were burnt in a wildfire, and although some Thornton kānuka seedlings are establishing in this area it now requires some active management to ensure that Thornton kānuka forest re-establishes on this site. Whakatane District is now actively replanting the site.

Weeds

Marram and African boxthorn are locally prominent on the sand dunes.

Discussion

This site includes protected and unprotected areas (including recreation reserves managed by Whakatane District Council). The unprotected areas are mapped (see 7j).

This site contains good quality representative examples of the sand dune vegetation and coastal wetland vegetation of the Te Teko Ecological District (see Beadel 1994a).

The Thornton kānuka forest and scrub on sand dunes are nationally rare vegetation types. These vegetation types would probably once have been common in the Te Teko Ecological District (there are large remnant kānuka trees on sand dunes near Whakatane estuary) and also in the Taneatua Ecological District (there are large Thornton kānuka trees in Whangakopikopiko Wildlife Management Reserve). Coastal wetland vegetation contiguous with sand dune vegetation has been greatly reduced in extent in New Zealand and is now a relatively uncommon feature.

One nationally threatened species is present (in the unprotected areas). Four at risk plant species are present (one of these, pīngao, occur in the areas of unprotected land), as well as in protected areas within Protected Area 7). All of this area should be formerly protected for natural values.

This natural area is of significant wildlife habitat value, supporting breeding populations of two threatened species; banded dotterel and variable oystercatcher.

Matata Wildlife Refuge and the sand dunes to the north of Matata Scenic Reserve are part of an interrupted altitudinal sequence of sand dunes, coastal wetlands and hill country vegetation. The hill country vegetation (part of which is protected within Matata Scenic Reserve) is in a different ecological district (Otanewainuku) and region (Northern Volcanic Plateau) and extends inland to Maungawhakamana.

The parts of this natural area that are unprotected are identified on the maps as 7j. These include areas of Thornton kānuka and

spinifex, pīngao, *Muehlenbeckia complexa* and *Ficinia nodosa*, and some areas dominated by exotic species. The Thornton kānuka species is classed as 'Taxonomically Indeterminate - Threatened-Nationally Vulnerable' and pīngao is classed as 'At Risk-Declining'. These areas (7j) are an important part of the dune ecosystem between Matata and Whakatane and are of high conservation significance.

Notes

There are several small Thornton kānuka stands outside of Site 7 which were too small to be included, however if these areas were fenced to exclude browsing animals this would enhance the likelihood of their long term survival, and would enhance the natural character of the ecological district.

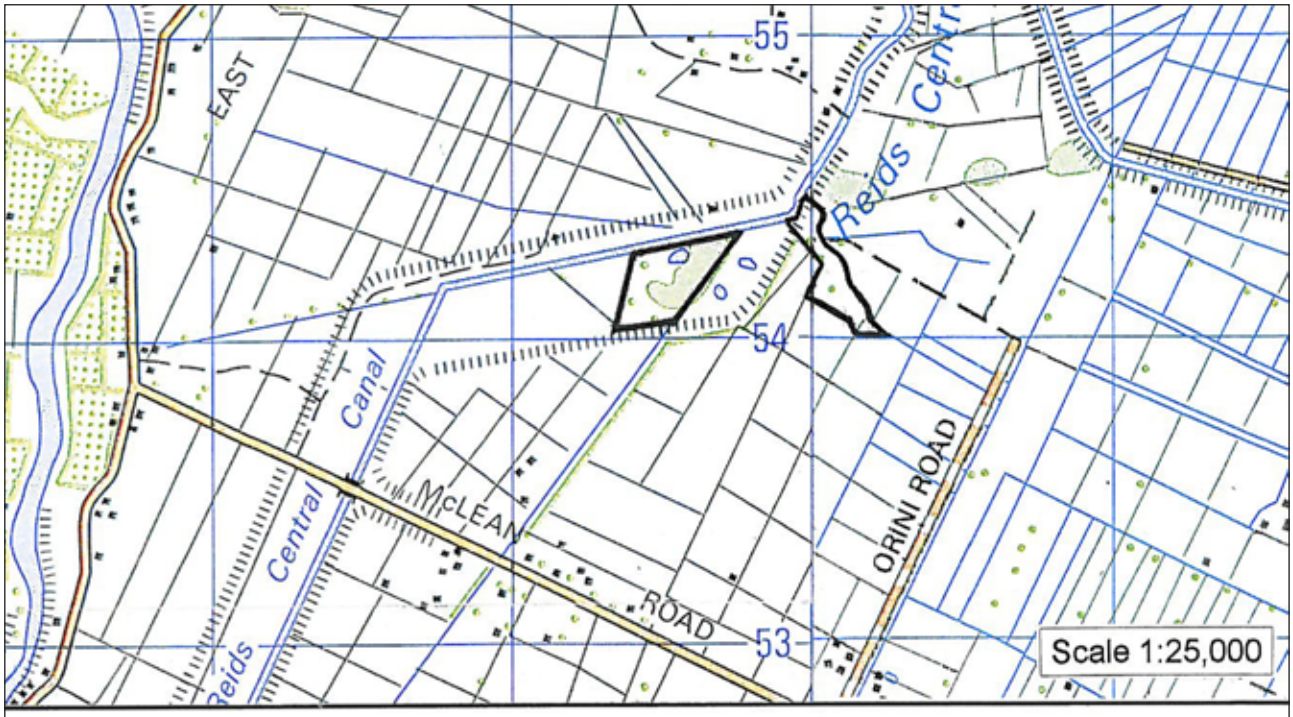
References

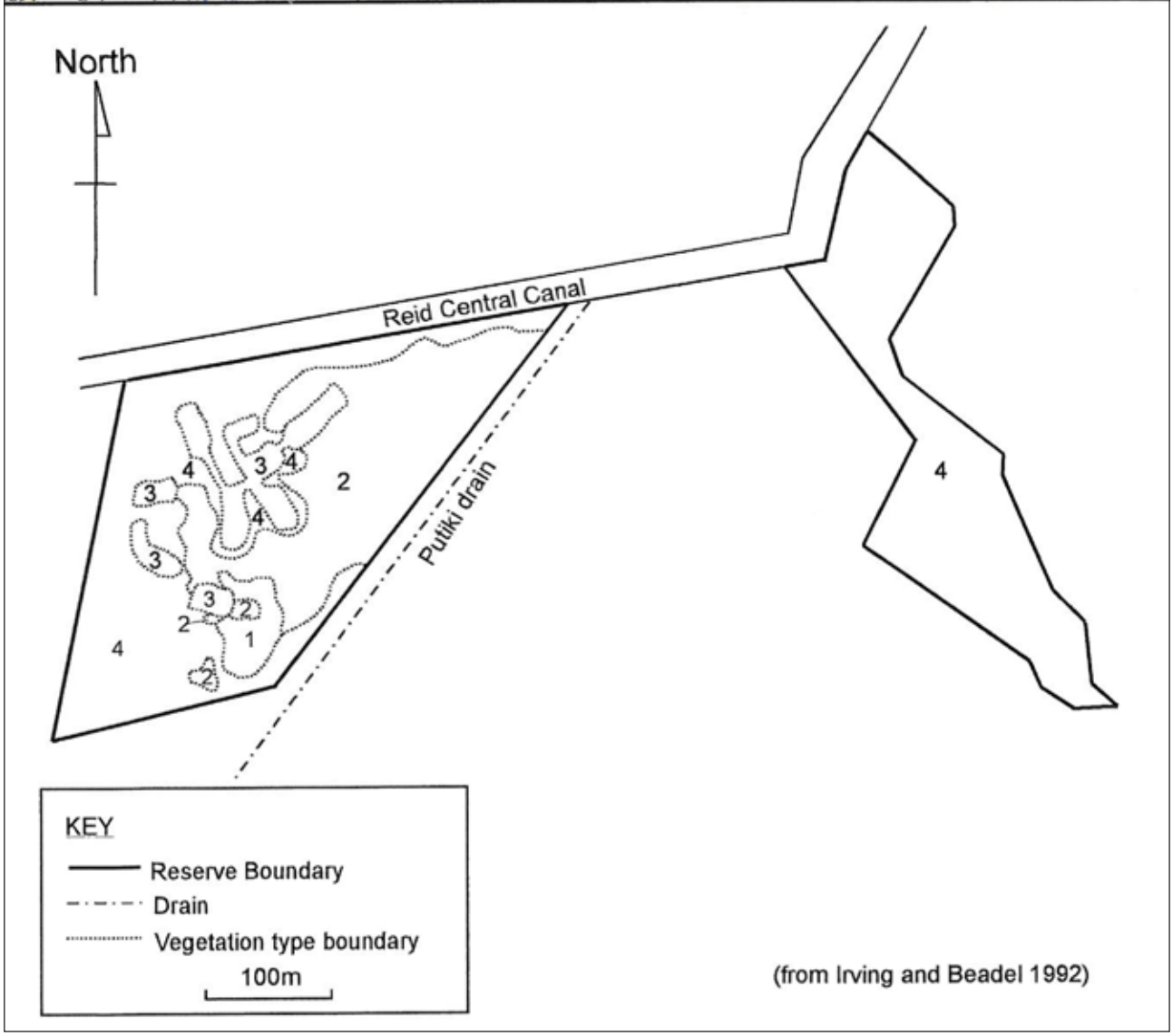
Beadel 1985, 1987, 1992d, 1992f, 1992i, 1994a; Irving 1992b; Miller 1983c.

Footnote

The vegetation of the Whakatane District Council Recreation Reserves was remapped and described in 2000 (Gosling and Beadel 2000a) subsequent to the current survey. The avifauna and habitats of these recreation reserves were surveyed and described in 2001 (Wildland Consultants 2001d).

8: Orini Wildlife Management Reserve





Orini Wildlife Management Reserve

Te Teko Natural Area No. 8
Grid Reference NZMS260 V15 496543; W15 501543
Area 11.02 ha
Landform Unit Wetland
Status Administered by FGNZ

BIOCLIMATIC ZONE	VEGETATION		LANDFORM
Semi-coastal	1.	Artificial ponds.	Wetland
	2.	Crack willow treeland.	Wetland
	3.	Raupō reedland.	Wetland
	4.	Pasture.	Wetland

Vegetation In the 19th century Orini Wildlife Management Reserve was part of a lagoon near the Orini River (the Orini River was dammed near where it left its present river, the Rangitaiki, in the early 1900s). Prior to drainage and establishment of weeds the vegetation around the lagoon would have been raupō, sedges, harakeke and tī kōuka (*cf.* Gibbons 1990).

Flora Taxa present include *Bolboschoenus fluviatilis*.

Fauna Birds present include spotless crake ('At Risk-Relict' in Miskelly *et al.* 2008), Australasian bittern ('Threatened-Nationally Endangered' in Miskelly *et al.* 2008), pukeko, N.Z. shoveller, grey duck and paradise shelduck (P. Fergusson pers. comm.).

A bat, probably long-tailed ('Acutely Threatened-Nationally Vulnerable' in Hitchmough *et al.* 2007) was seen above the reserve in May 1997 (L. Barea, DOC, pers. comm.).

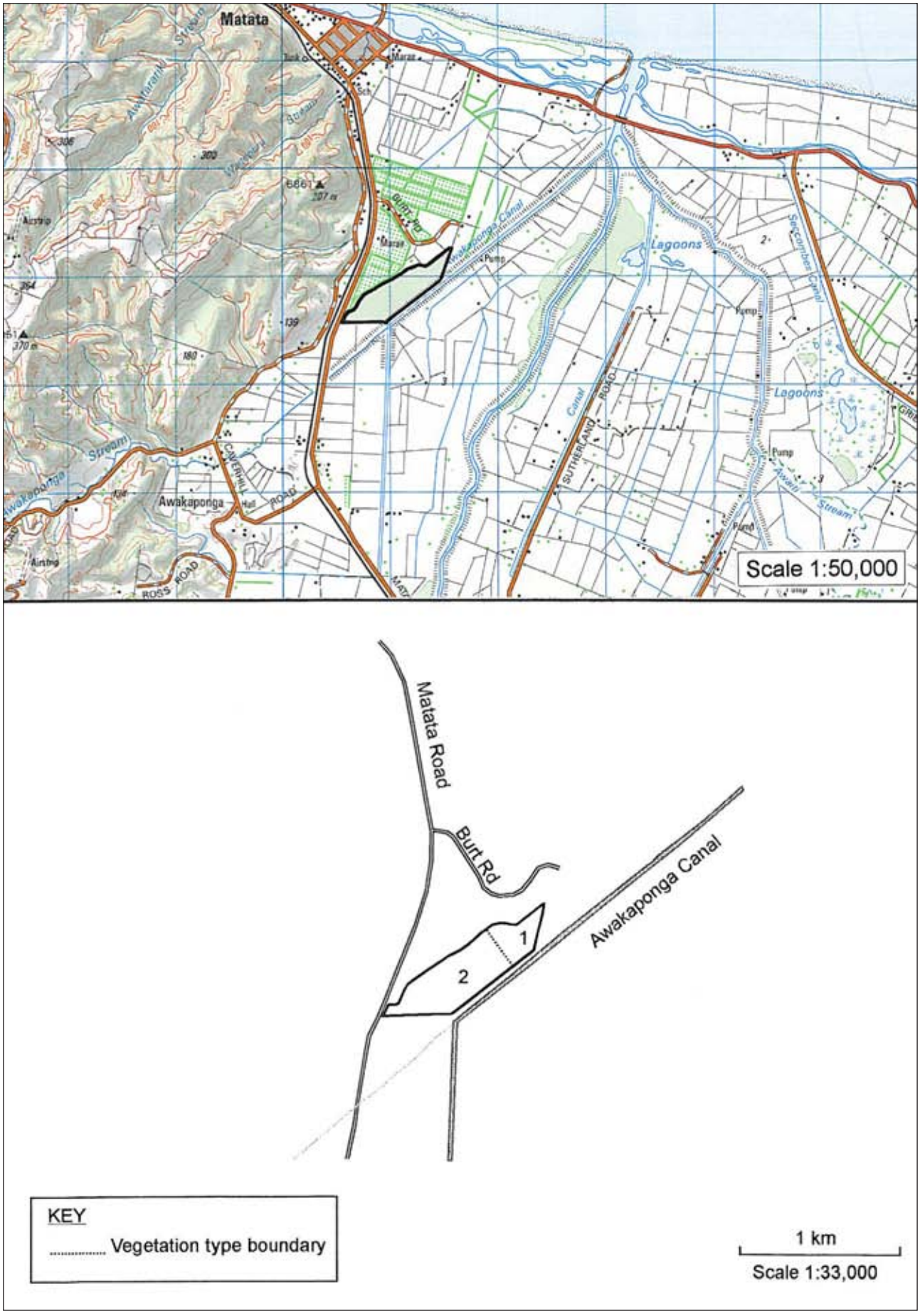
Threat/Modification This eastern part of the reserve was cleared of willow and drained in 1972 and is now pasture with a few scattered mature tī kōuka. Both parts of the reserve were grazed in 1991 and the western part of the reserve showed signs of recent heavy grazing and trampling when visited in July 1991.

The main weed species present are blackberry, crack willow, pampas, reed sweetgrass and tradescantia (*Tradescantia fluminensis*). The invasion of crack willow into the reserve would have replaced the original canopy species e.g., raupō, mānuka, tī kōuka and sedges. The dense willow canopy now present in places has contributed to the disappearance of the indigenous species from the understorey. (See Beadel 1992h pp.95 and 96 for more information).

Discussion Much of the western part of the reserve is dominated by naturalised species and all of the eastern part (only three indigenous taxa were recorded in the eastern part).

References Beadel 1992h.

9: Kopuatawhiti



Kopuatawhiti

Te Teko Natural Area No.	9
Grid Reference	NZMS260 V15 410587
Area	22.63 ha
Landform Unit	Wetland
Status	Unprotected
Recommended Area for Protection	Yes

BIOCLIMATIC ZONE	VEGETATION	LANDFORM
Semi-coastal	1. Felled grey willow forest (grey willow has recently been felled over all this part of the wetland, this area is now mainly willow regrowth and reed sweetgrass with limited areas of open water and *Carex secta*. Willow debris had been windrowed and the area is quite degraded). 2. • Grey willow/*Coprosma tenuicaulis* forest. • Grey willow/manuka-*Baumea rubiginosa* forest • Grey willow-crack willow/reed sweet grass-black nightshade-Japanese honeysuckle shrubland • Blackberry shrubland • Yorkshire fog grassland • Reed sweet grass-Yorkshire fog-blackberry grassland • *Carex geminata*-blackberry sedgeland • *Carex virgata-Cyperus ustulatus-Schoenoplectus tabernaemontani*-Japanese honeysuckle-blackberry sedge-vineland • Lombardy poplar/dead bracken-blackberry fern-shruband (Wildland Consultants Ltd 2011)	Freshwater wetland

Vegetation Wetland vegetation which has been modified by drainage of the surrounding land and about a third of the area has been further modified by recent clearing of the willow.

Flora *Cyclosorus interruptus* (classed as 'At Risk-Declining' in de Lange *et al.* 2009) occurs in this wetland. A relativley large, healthy population of burr reed is present. This is a regionally uncommon species and is known from only a few other sites in the ecological district. Other regionally uncommon species present are wire rush and *Nertera scapanioides*. Three species present have not been recorded elsewhere in the ecological district—*Metrosideros fulgens*, *Freycinetia banksii*, and *Diplodium alobulum*. Other species present include *Baumea tenax*, *Eleocharis gracilis, Hydrocotyle pterocarpa*, and *Baumea juncea*.

Fauna Species present include spotless crake ('At Risk-Relict' in Miskelly *et al.* 2008), mallard, grey duck, kawau, kotare, kahu, and pukeko

Threats/Modifications About one third of this area has recently been cleared and further development of the wetland is proposed (Shaw 1996).

Discussion The vegetation and wildlife habitats of Kopuatawhiti wetland are highly degraded, and would require considerable management input to improve its condition. This would involve willow control and increasing the amount of water in the wetland (there is a pump adjacent to the Awakaponga Canal

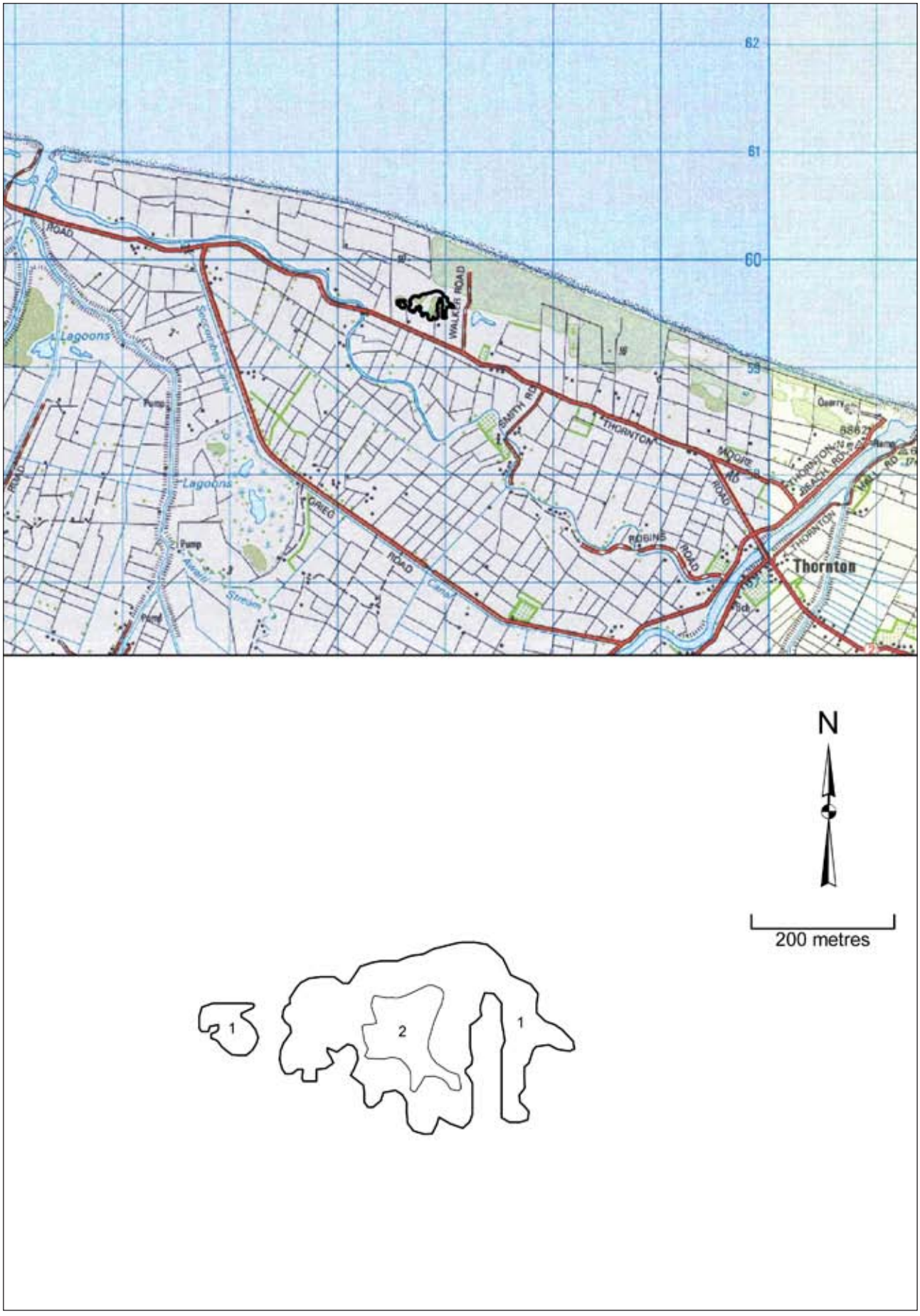
which appears to be actively pumping water from the wetland). However, although degraded, a significant proportion of the wetland has an understorey of mainly indigenous species. The wetland also contains a small population of a rare fern *Cyclosorus interruptus*, and is a habitat for *c.* 11 indigenous bird species.

Wetland habitat in the ecological district has been dramatically reduced in extent since 1840, with only about 2.4% remaining of the once extensive Rangitaiki Wetland (*c.* 27,500 ha). This highlights the significance of any remaining wetland areas.

References

Beadel 1995b.

10: Wahieroa Wetland



Wahieroa Wetland

Te Teko Natural Area No. 10
Grid Reference NZMS260 V15 467596
Area 6.41 ha
Landform Unit Wetland
Status Protected by Section 221, RMA Covenant

BIOCLIMATIC ZONE	VEGETATION		LANDFORM
Coastal	1.	(Grey willow)/Mercer grass-*Schoenoplectus tabernaemontani* sedge-grassland; Grey willow-(tī kōuka) forest; Bamboo forest; Open water; Grey willow forest.	Wetland
	2.	(Grey willow)/raupō reedland.	Wetland

Vegetation Map A vegetation map of this site is presented in Gosling 2001a.

Vegetation Grey willow forest dominates the site with occasional tī kōuka. In open areas reed sweetgrass forms dense swards but elsewhere indigenous carexes and willow weed (*Polygonum persicaria*) is common. Duckweed covers the surface of areas where water has ponded. Mercer grass and kāpūngāwhā (*Schoenoplectus tabernaemontani*) are locally dominant.

Flora No significant species have been recorded from this site.

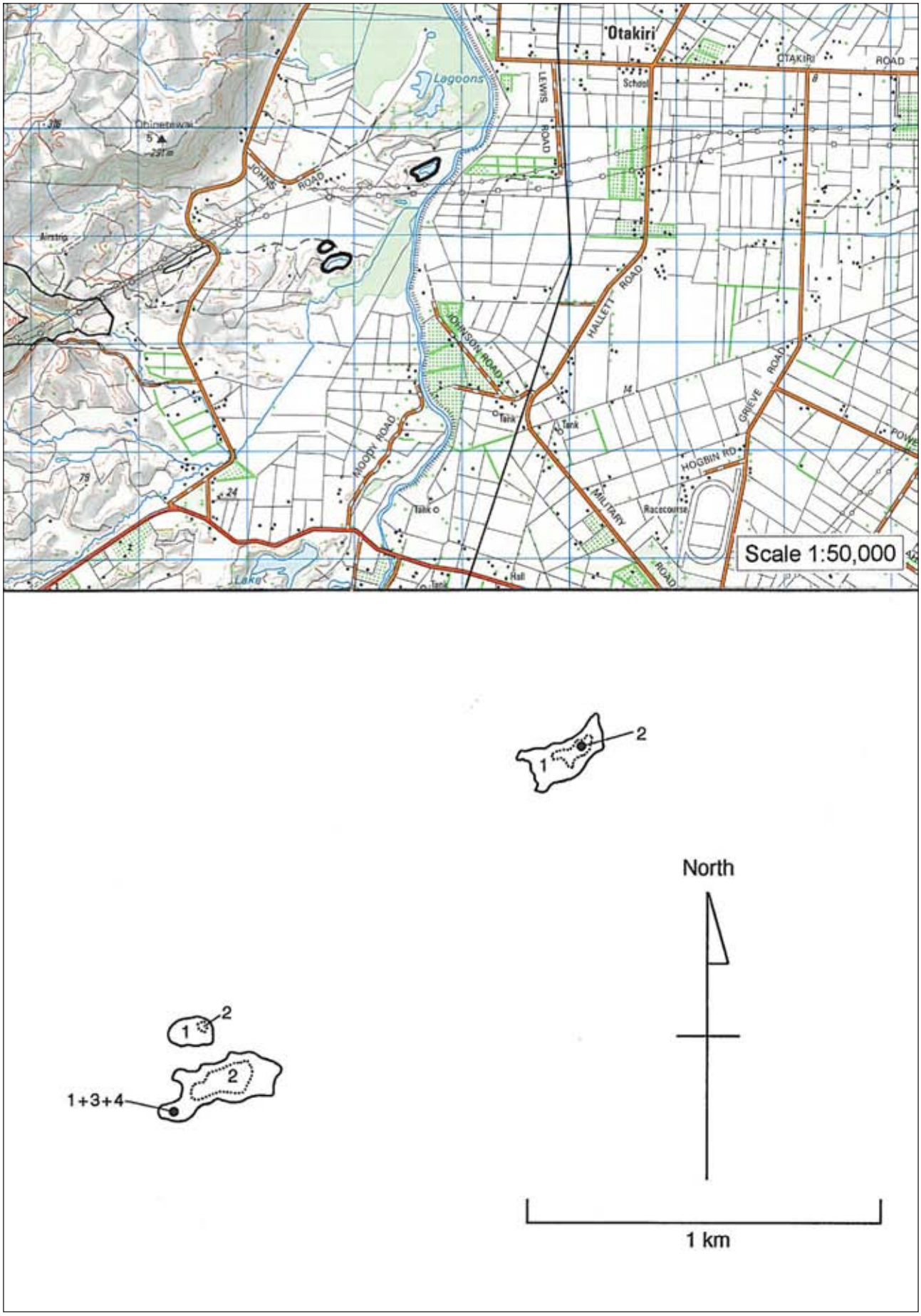
Fauna Spotless crake ('At Risk-Relict' in Miskelly *et al*. 2008) have been recorded from this wetland (Rasch 1989).

Discussion This site contains significant wildlife habitat; spotless crake have been recorded from here.

Wetland vegetation in Te Teko Ecological District has been dramatically reduced in extent. Although relatively small the wetland is one of the few remaining examples of wetland vegetation in the district.

Footnote This wetland was resurveyed in 2001 (see Gosling 2001a).

11: Mangaone Stream Wetlands



Mangaone Stream Wetlands

Te Teko Natural Area No.	11
Grid Reference	NZMS260 V15 377487; NZMS260 V15 377488; NZMS260 V15 387496
Area	4.07 ha
Landform Unit	Wetland
Status	Unprotected
Recommended Area for Protection	Yes

BIOCLIMATIC ZONE	VEGETATION	LANDFORM
Semi-coastal	1. Grey willow forest.	Wetland
	2. *Carex secta-Baumea articulata*-giant spike sedge-harakeke reedland.	Pond; wetland
	3. Reed sweetgrass grassland.	Wetland
	4. Raupō reedland.	Wetland

Vegetation

The southern wetland comprises a small pond surrounded by reedland of *Carex secta, Baumea articulata,* giant spike sedge with locally common harakeke. This in turn is surrounded by a raupō reedland. The other two areas comprise small areas of open water surrounded by grey willow with indigenous species common in the understorey.

Flora

Cyclosorus interruptus (classed as 'At Risk-Declining' in de Lange *et al.* 2009) and wire rush were recorded during this survey. Wire rush is a regionally threatened species (Beadel 2009) and is known from only one other site in the Te Teko Ecological District.

Fauna

No significant species were recorded during this survey.

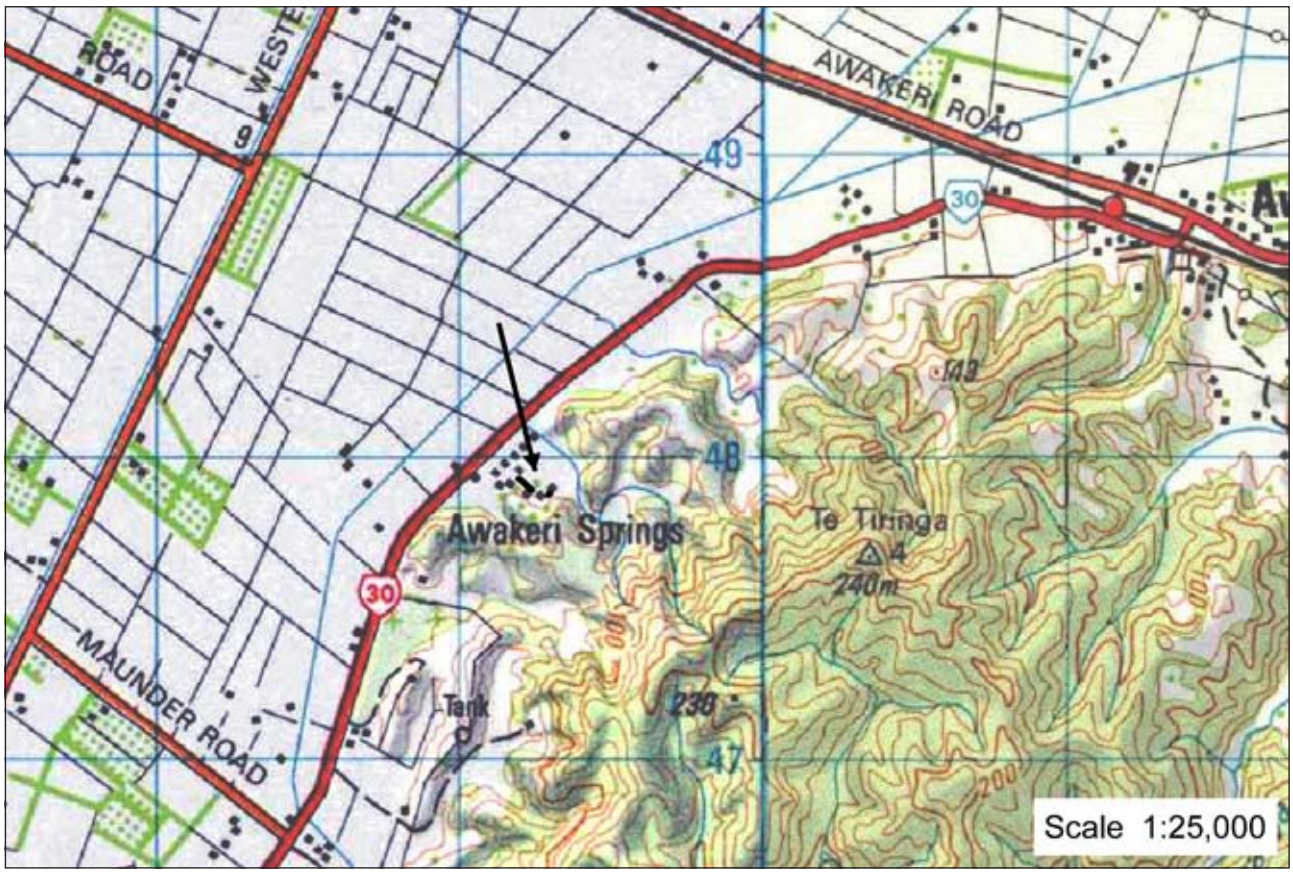
Discussion

Wetland vegetation has been dramatically reduced in extent in the Te Teko Ecological District. Although these wetland areas are relatively small, they contain remnant examples of wetland vegetation of the ecological district, and support a population of an at risk plant species and regionally uncommon plant species.

Notes

The southern-most part is contiguous with a wild area (W27: Mangaone Stream willow forest, see Appendix 6).

12: Pukaahu Spring



Pukaahu Spring

Te Teko Natural Area No.	12
Grid Reference	NZMS260 V15 493478
Area	0.04 ha
Landform Unit	Alluvial plain
Status	Recreation Reserve
Recommended Area for Protection	Yes

BIOCLIMATIC ZONE	VEGETATION		LANDFORM
Semi-coastal	1.	Kānuka-black wattle-(rewarewa; *Knightia excelsa*) forest.	Flat and hillslope
	2.	Geothermal pool.	Pool

Vegetation

Kānuka and black wattle forest, with occasional rewarewa, forest surrounds a small geothermal pool. The understorey is spare with cotoneaster (*Cotoneaster glaucophyllus*), *Schoenus tendo*, hangehange (*Geniostoma ligustrifolium* var. *ligustrifolium*), mingimingi (*Leucopogon fasciculatus*) and Japanese honeysuckle common. A small population of *Dicranopteris linearis* (*c.* 32 × 2 m) occurs on the margins of a geothermal pool. Scattered kānuka to 12 m, with a single banana palm (*Musa* ×*paradisiaca*) over *Dicranopteris linearis,* canna lilies (*Canna indica*) with a few vines of Japanese honeysuckle and blackberry intertwined with *Dicranopteris linearis*. Ground cover is mown grass. Mercer grass occurs in the shallow margins of the geothermal pool.

Flora

Dicranopteris linearis (classed as 'At Risk-Naturally Uncommon) in de Lange *et al*. 2009) is present at this site. Another small population of *Dicranopteris linearis* was recorded 10 m north of this site by Beadel (1992j&k), but this site was not relocated during the present survey. This may be due to winter dieback (discussed in Beadel 1992j&k).

Fauna

No significant species were recorded at this site.

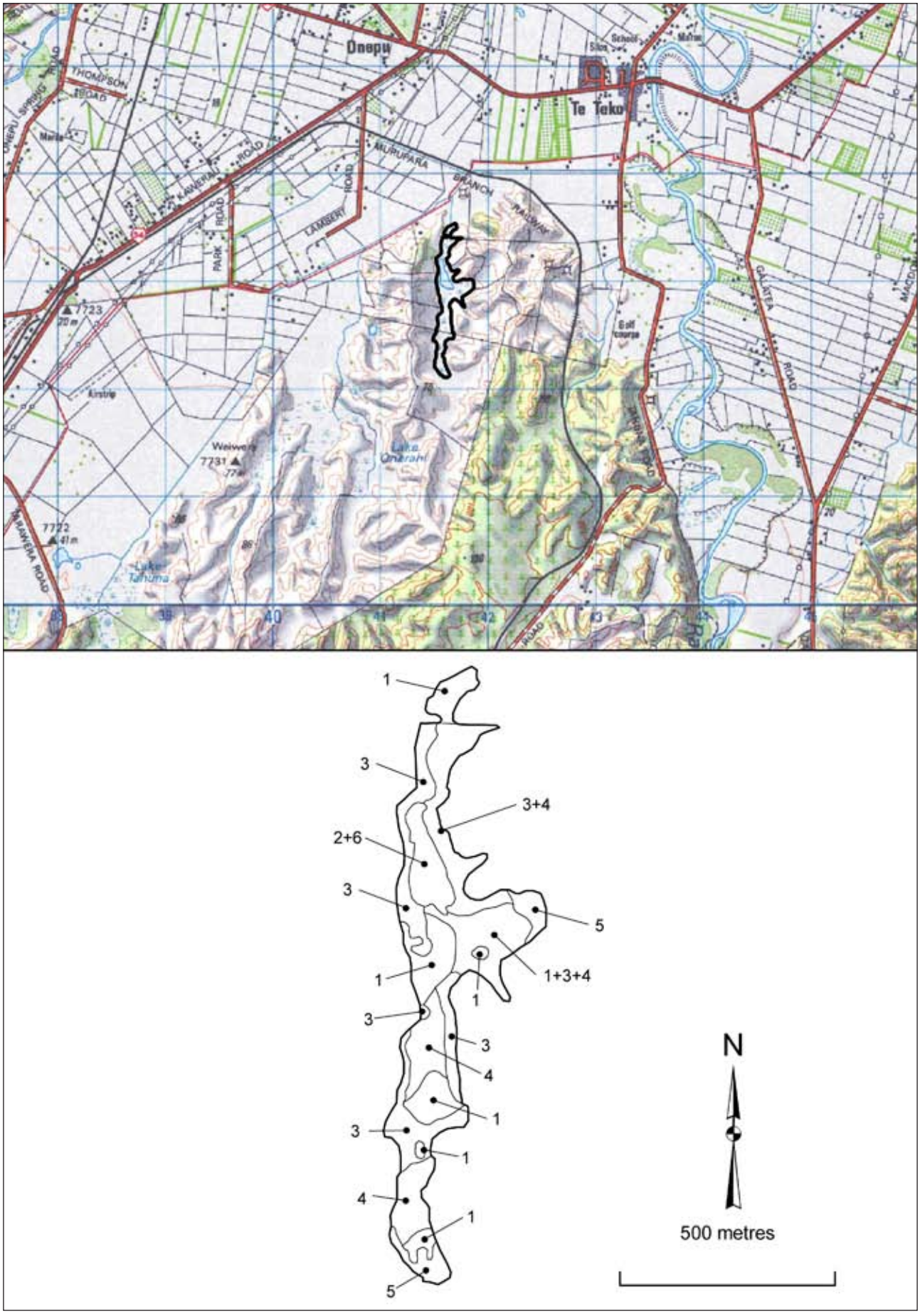
Justification

Weed control around the pond margins is undertaken regularly by DOC contractors and the population of *Dicranopteris linearis* is healthy and free from weed competition (although canna lilies are still present at the site). This is the only site where *Dicranopteris linearis* occurs in the Te Teko Ecological District, although it has previously been recorded from a nearby site (see Beadel 1992k). This site is of significance because it contains a population of an at risk species.

References

Beadel *et al*. 1996a.

13: Lambert's Wetland



Lambert's Wetland

Te Teko Natural Area No.	13
Grid Reference	NZMS260 V15 415425
Area	18.65 ha
Landform Unit	Wetland
Status	Unprotected
Recommended Area for Protection	Yes

BIOCLIMATIC ZONE	VEGETATION	LANDFORM
Semi-coastal	1. Grey willow forest.	Wetland
	2. Raupō reedland.	Wetland
	3. *Baumea rubiginosa*-raupō-*Carex secta*-*Carex* sp. (*C. geminata* agg.) shrub-reed-sedgeland.	Wetland
	4. Grey willow-mānuka shrubland.	Wetland
	5. *Carex secta*-Yorkshire fog (*Holcus lanatus*) tussockland ⇔ Yorkshire fog grassland.	Wetland
	6. Open water.	Pond

Vegetation

Grey willow forest is the dominant vegetation throughout the northern part of this wetland.

Raupō reedland dominates the wetter parts of this site with occasional *Carex secta* and giant spike sedge. Parts of the wetland comprise a mosaic of raupō reedland, giant spike sedge reedland and open water.

A shrub-reed-sedgeland dominated by raupō, *Baumea rubiginosa*, *Carex secta* and *Carex* sp. (*C. geminata* agg.) occurs in the middle part of this wetland. This vegetation type is variable, and mānuka, *Coprosma propinqua* subsp. *propinqua* and harakeke are also locally dominant.

At the southern end of the gully, a tussockland of *Carex secta* and Yorkshire fog, with local *Carex* sp. (*C. geminata* agg.), gorse, grey willow and mānuka is the dominant vegetation type. Tussocks become scattered further up the gully, and eventually form a Yorkshire fog grassland.

Kānuka forest occurs on the hillslopes on the northwestern side of the wetland outside of the Te Teko ED.

Flora

No significant plant species were noted at this site during the survey.

Fauna

One at risk species and one threatened species use the site - New Zealand dabchick (Threatened-Nationally Vulnerable) and North Island fernbird ('At Risk-Declining' in Miskelly *et al.* 2008). Other species recorded are New Zealand scaup, paradise shelduck, white faced heron, pukeko, grey warbler, fantail, spur-winged plover, mallard duck, pheasant and Californian quail.

Discussion

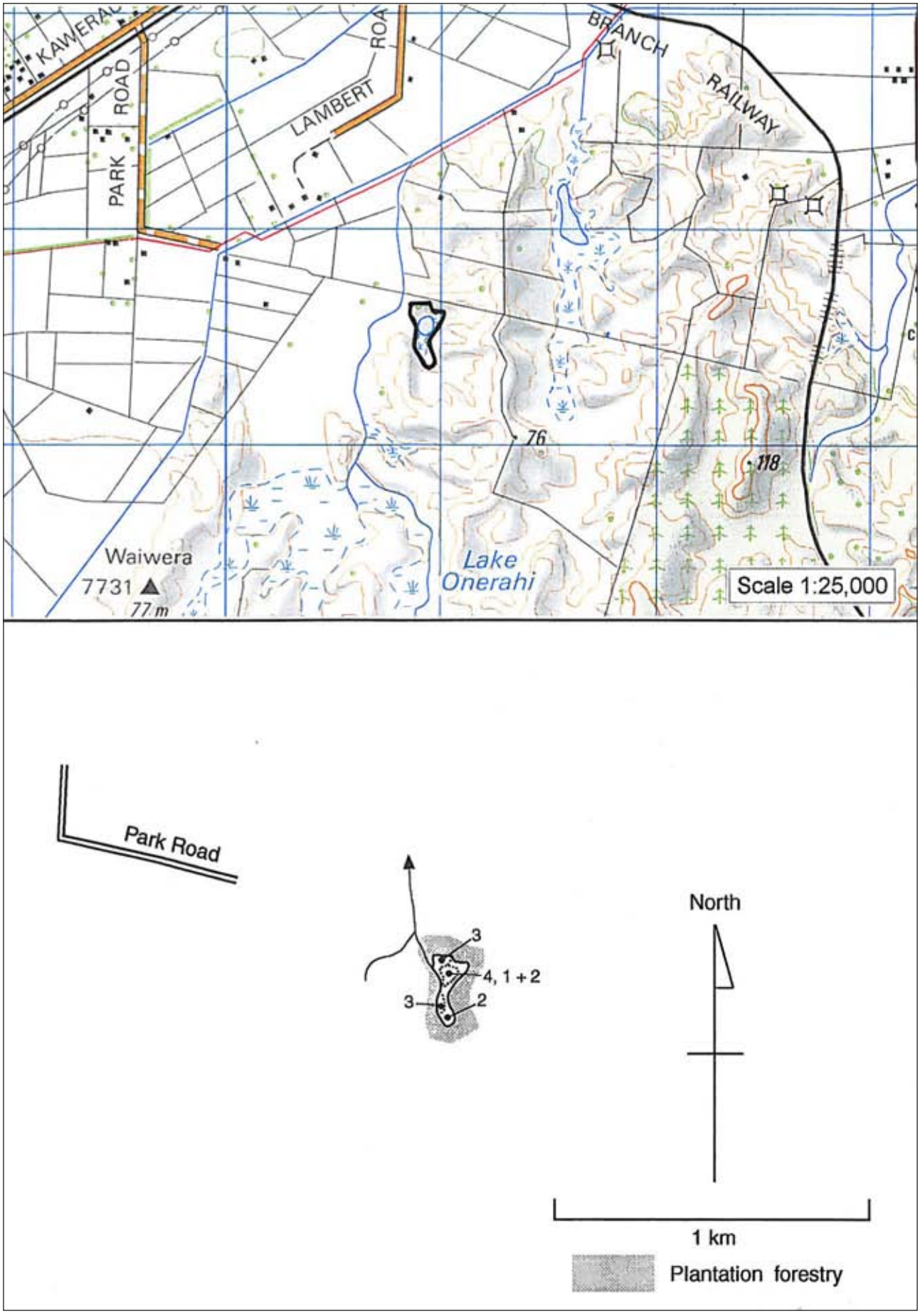
Wetland vegetation in Te Teko Ecological District has been dramatically reduced in extent. This wetland is a representative example of the wetland vegetation of the ecological district.

One at risk and one threatened bird species occur in the site.

Notes

This natural area was initially identified in the 1996 Whakatane District study (Beadel *et al*. 1996b). The site identified in the Whakatane District study includes a nearby area of kānuka forest in the Kaingaroa Ecological District. This area is outside Te Teko ED and so is not shown on the map in this report.

14: Park Road Wetland



Park Road Wetland

Te Teko Natural Area No. 14
Grid Reference NZMS260 V15 409424
Area 0.96 ha
Landform Unit Wetland
Status Unprotected
Recommended Area for Protection Yes

BIOCLIMATIC ZONE	VEGETATION	LANDFORM
Semi-coastal	1. Giant spike sedge reedland.	Wetland
	2. Raupō reedland.	Wetland
	3. Grey willow forest.	Wetland
	4. Open water.	Pond

Vegetation

Grey willow forest is the dominant vegetation type. Tī kōuka are occasional in the canopy. The understorey is dominated by *Carex secta* and swamp kiokio with scattered whekī, water fern and *Baumea tenax*.

Where grey willow has not invaded, a reedland comprising raupō, with locally abundant swamp millet and *Baumea articulata* is dominant. *Carex secta* and *Eleocharis acuta* occur locally.

Open water is fringed by a giant spike sedge reedland.

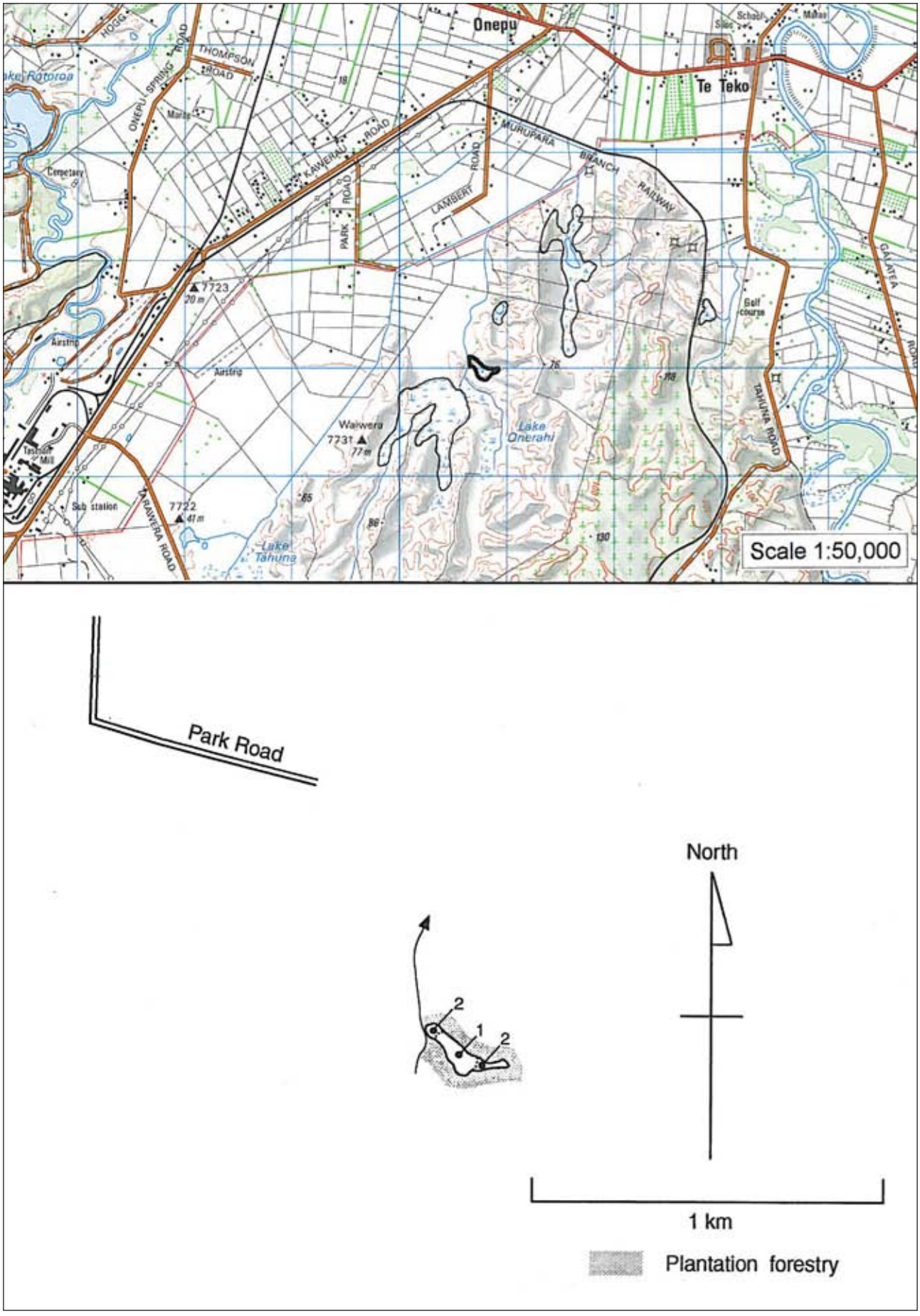
Flora and Fauna

No significant species were recorded during this survey.

Discussion

The extent of wetland vegetation in Te Teko Ecological District has been dramatically reduced since 1840, and although this site is relatively small and modified, it comprises one of the few remaining examples of wetland vegetation.

15: Onerahi Wetland



Onerahi Wetland

Te Teko Natural Area No. 15
Grid Reference NZMS260 V14 407420
Area 1.02 ha
Landform Unit Wetland
Status Unprotected
Recommended Area for Protection Yes

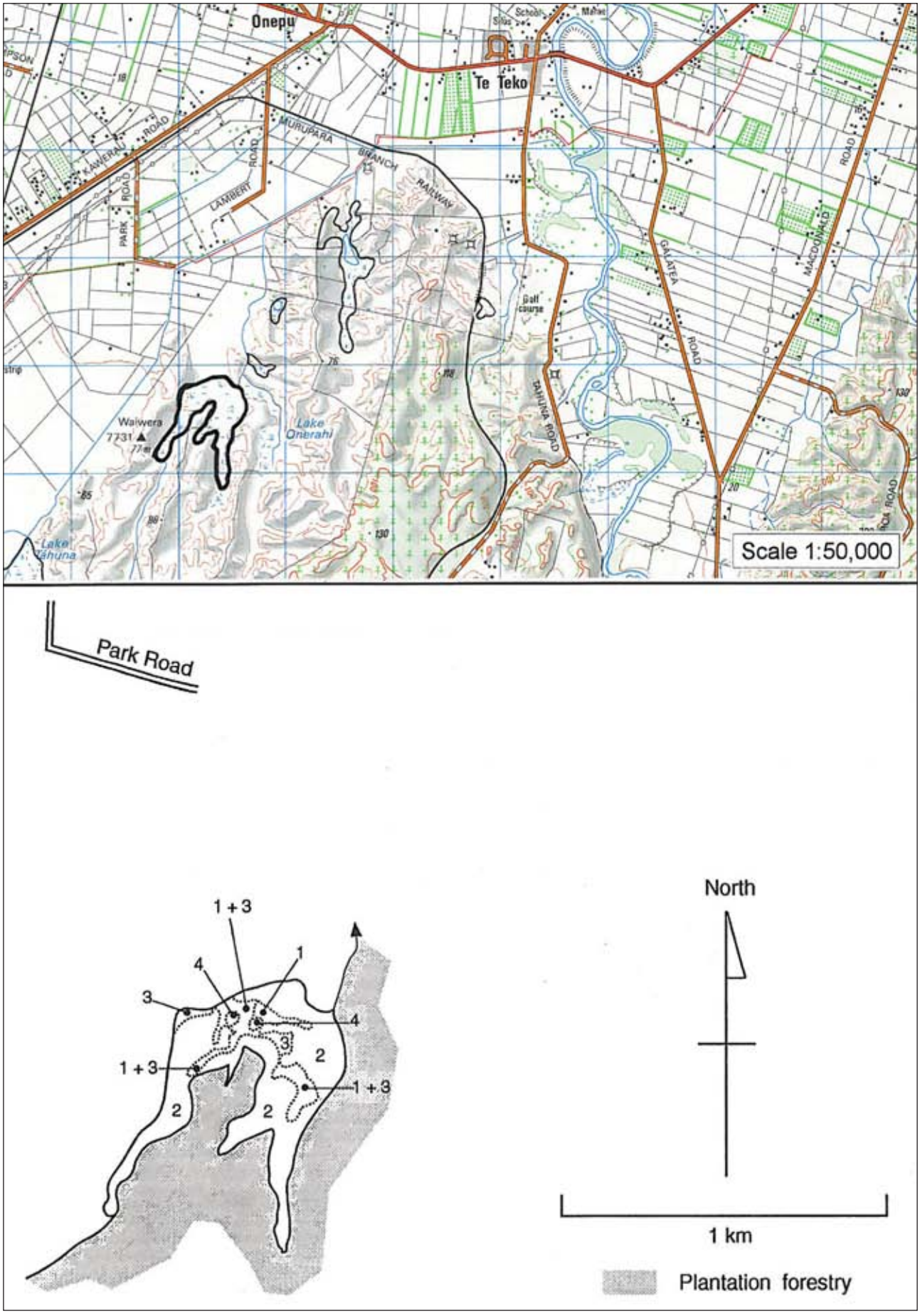
BIOCLIMATIC ZONE	VEGETATION	LANDFORM
Semi-coastal	1. Grey willow forest.	Gully wetland
	2. *Baumea articulata*-(raupō) reedland.	Gully wetland

Vegetation This wetland is dominated by grey willow forest with an understorey of *Carex secta* and swamp kiokio, with local *Baumea articulata*. Two small patches of *Baumea articulata* reedland, with occasional raupō, and a few examples of swamp coprosma occur here.

Flora and Fauna No significant species were noted at this site during the survey.

Discussion The extent of wetland vegetation in the Te Teko Ecological District has been dramatically reduced since 1840, and although this site is relatively small and modified, it comprises one of the few remaining examples of wetland vegetation.

16: Lake Onerahi Wetland



Lake Onerahi Wetland

Te Teko Natural Area No.	16
Grid Reference	NZMS260 V15 405417
Area	28.86 ha
Landform Unit	Wetland
Status	Unprotected
Recommended Area for Protection	Yes

BIOCLIMATIC ZONE	VEGETATION	LANDFORM
Semi-coastal	1. Raupō/*Carex secta* sedge-reedland.	Wetland
	2. Grey willow forest.	Wetland
	3. Raupō-*Bolboschoenus fluviatilis* sedge-reedland.	Wetland
	4. Open water	Pond

Vegetation

Grey willow forest is the dominant vegetation type at this site. Its understorey is dominated by *Carex secta* and swamp kiokio with local *Baumea rubiginosa* and scattered *Baumea articulata*. One local infestation of reed sweetgrass was noted.

There are areas with a high water table around the margins of the wetland. These are dominated by a raupō and *Bolboschoenus fluviatilis* reed-sedgeland, with local swamp millet and *Coprosma propinqua* subsp. *propinqua*.

Flora

No significant species were recorded during this survey.

Fauna

Australasian bittern ('Threatened-Nationally Endangered' in Miskelly *et al*. 2008), and North Island fernbird ('At Risk-Declining' in Miskelly *et al*. 2008) are both found in the site. Other species present include pukeko and kingfisher.

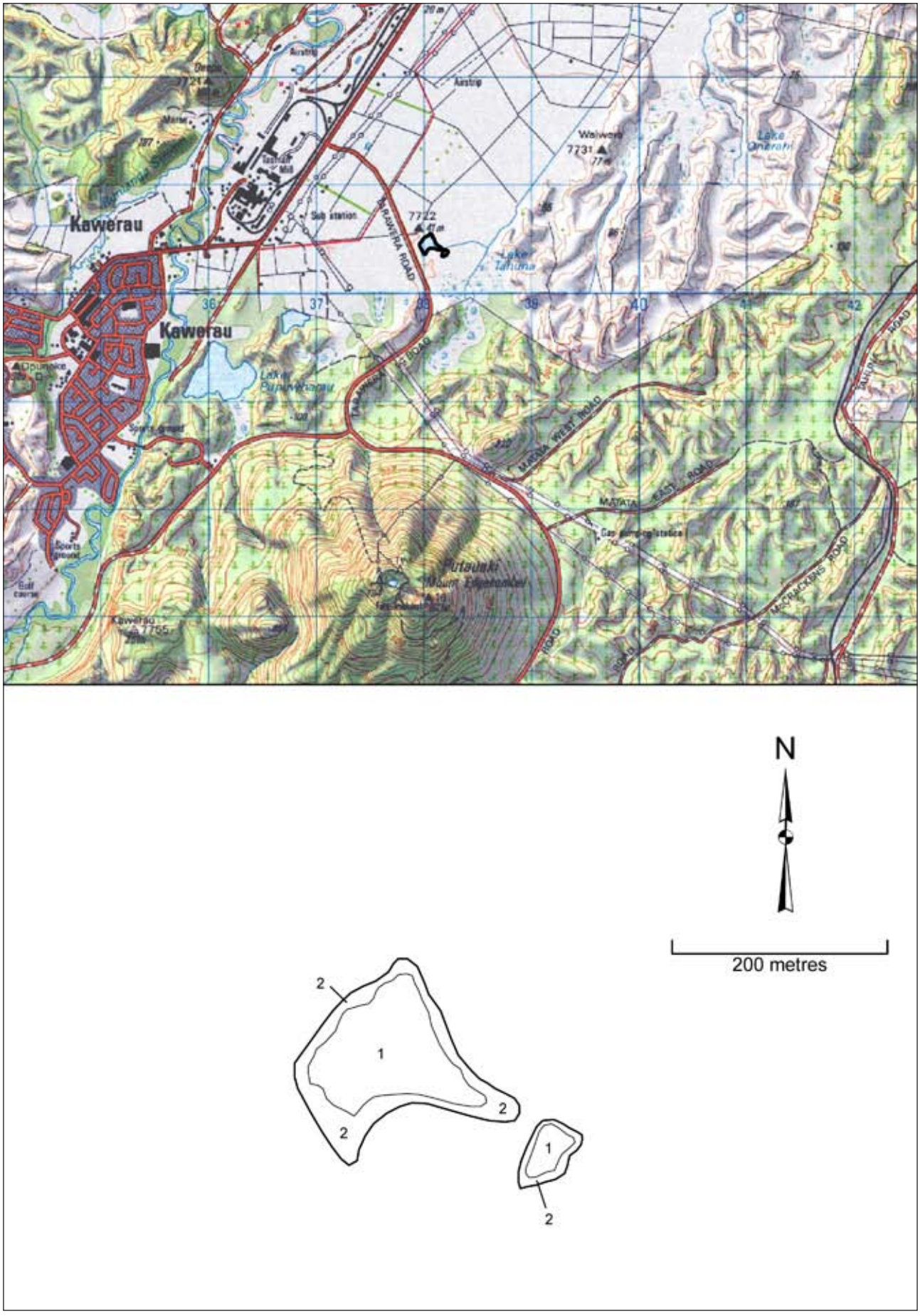
Discussion

This site contains a relatively good quality representative example of the wetland vegetation of the ecological district. One threatened and one at risk species are present.

References

Beadel *et al*. 1996b.

17: Tarawera Road Wetland



Tarawera Road Wetland

Te Teko Natural Area No.	17
Grid Reference	NZMS260 V15 380404
Area	2.13 ha
Landform Unit	Wetland
Status	Unprotected
Recommended Area for Protection	Yes

BIOCLIMATIC ZONE	VEGETATION	LANDFORM
Semi-coastal	1. Open water.	Pond
	2. Raupō reedland; Giant spike sedge reedland; *Juncus effusus* tussockland.	Wetland

Vegetation

This site comprises two ponds. The larger pond is surrounded with areas of giant spike sedge reedland and raupō reedland, with local *Baumea articulata*. Tussockland of *Juncus effusus* forms a buffer between these types, and pasture and gorse shrubland. Floating sweet grass, clustered dock (*Rumex conglomeratus*), and *Juncus articulatus* are scattered around the pond margins.

Flora and Fauna

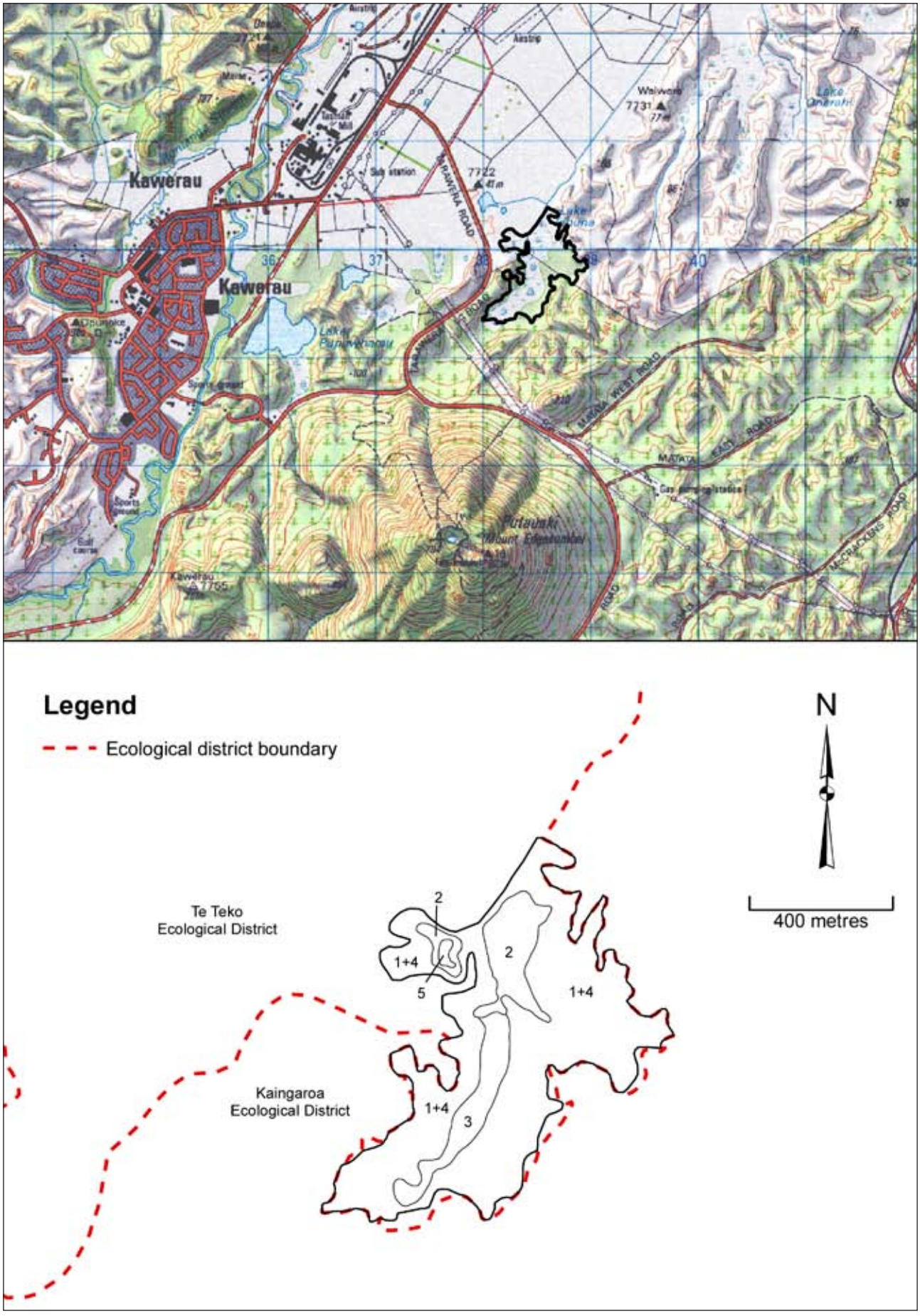
No significant species were recorded during the field survey.

Discussion

Wetland vegetation has been greatly reduced in extent in the ecological district, and although this site is relatively small and modified, it comprises one of the few remaining examples of wetland vegetation.

A significant feature of this wetland is the virtual absence of grey willow (naturalised species) which is prevalent in many of the wetlands on the Te Teko alluvial plain (one shrub was seen in the site in 2009).

18: Lake Tahuna Wetland



Lake Tahuna Wetland

Te Teko Natural Area No.	18
Grid Reference	NZMS260 V15 385402
Area	44.12 ha
Landform Unit	Wetland
Status	Unprotected
Recommended Area for Protection	Yes

BIOCLIMATIC ZONE	VEGETATION		LANDFORM
Semi-coastal	1.	Grey willow forest.	Wetland
	2.	Raupō reedland ⇔ raupō-*Carex secta* sedgeland.	Wetland
	3.	Grey willow/raupō shrubland ⇔ (grey willow)/*Baumea rubiginosa*-swamp kiokio-*Carex secta* sedgeland.	Wetland
	4.	Tī kōuka/bracken-karamū-mānuka shrubland.	Wetland margins and hillslopes
	5.	Open water	Pond

Vegetation

Grey willow forest is the dominant vegetation type at this site. Karamū, *Baumea tenax*, *Pneumatopteris pennigera*, swamp kiokio, and *Carex secta* dominate the understorey with occasional *Baumea rubiginosa* and *Baumea juncea*. *Coprosma propinqua* subsp. *propinqua* is scattered throughout, and harakeke occurs locally.

Grey willow has recently invaded some areas, and scattered to occasional plants emerge over a mosaic comprising shrublands and sedgelands dominated by raupō, *Baumea rubiginosa*, swamp kiokio and *Carex secta*. Scattered *Coprosma propinqua* subsp. *propinqua*, and occasional *Baumea articulata* also occur.

Raupō reedland, and raupō-*Carex secta* sedgeland form a mosaic in the central part of the wetland. *Carex maorica* and swamp kiokio occur locally throughout this vegetation type; *Azolla filiculoides* is common on open water.

A rushland of *Juncus effusus* and *Juncus acuminatus* forms a buffer between the site and adjacent pasture, and a narrow zone of mānuka scrub occurs between the rushland and the grey willow forest. Spanish heath (*Erica lusitanica*) and *Carex maorica* are occasional, and *Juncus effusus*, *Juncus edgariae* and swamp millet are locally abundant.

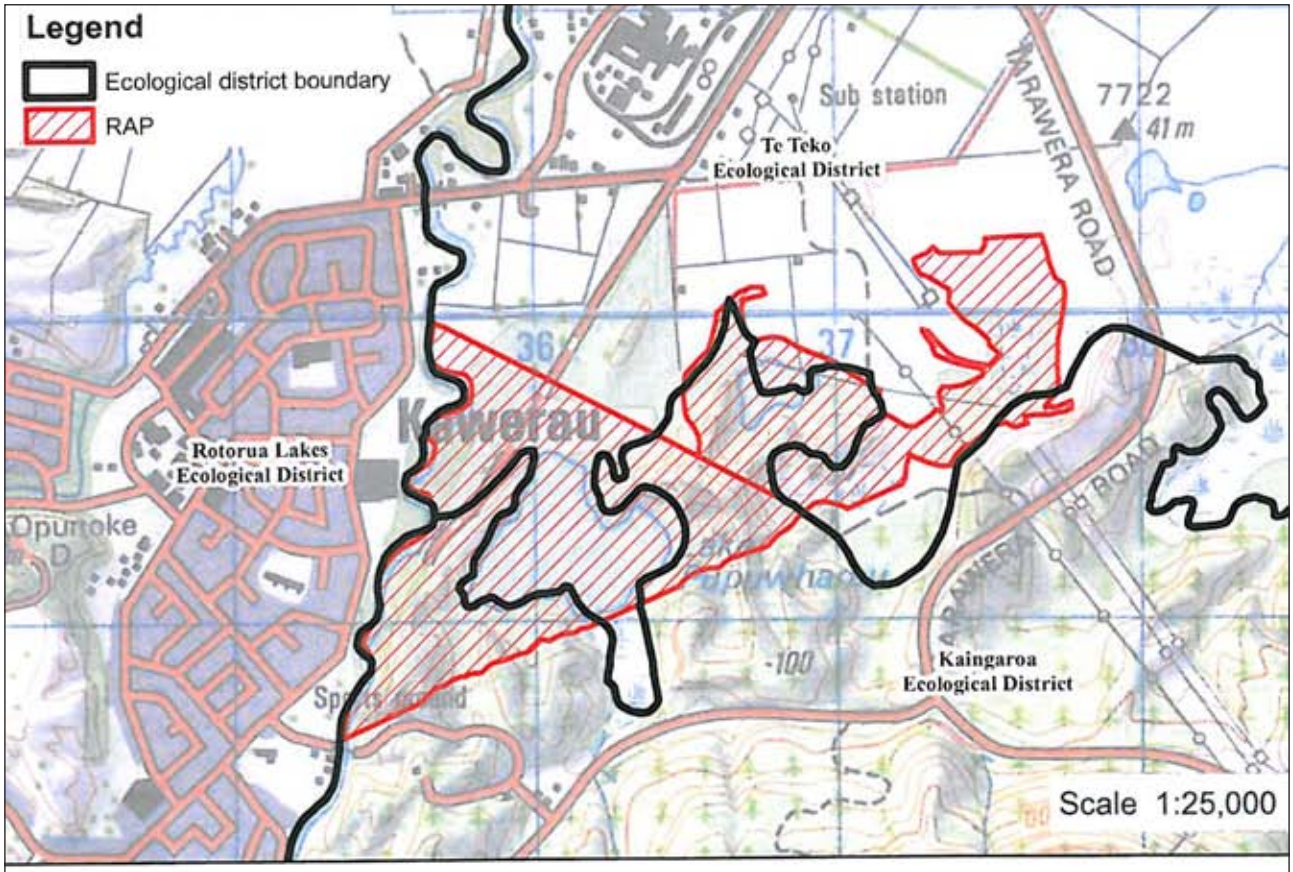
On gentle hillslopes to the south of the site, bracken, karamū and mānuka form a shrubland with occasional emergent tī kōuka.

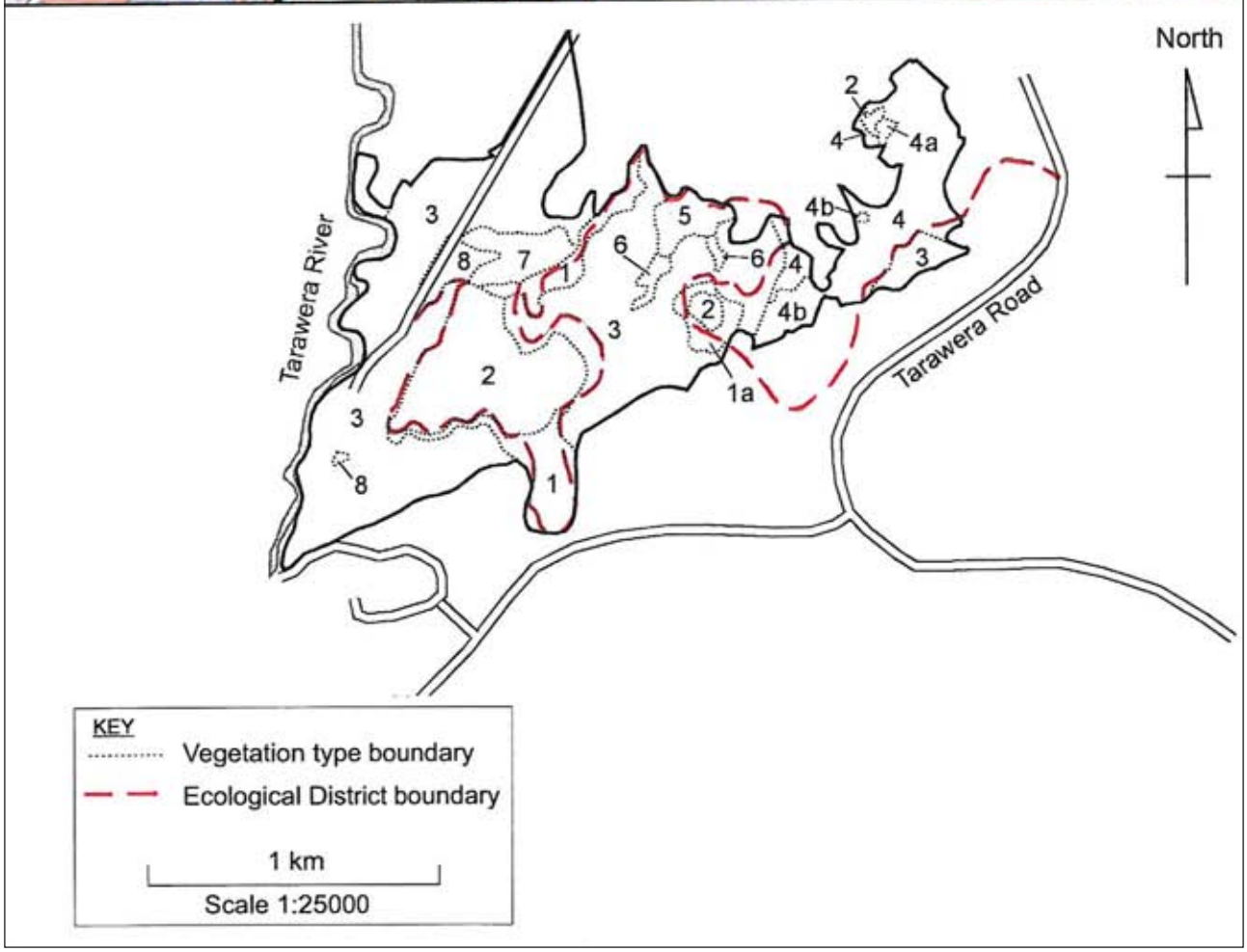
Flora

Two species classed as 'At Risk-Declining' in de Lange *et al.* (2009) (*Cyclosorus interruptus* and *Thelypteris confluens*) occur nearby at Lake Pupuwharau. Although this site contains suitable habitat, these two species were not recorded during

	the current survey. A more detailed survey of the site should be carried out.
Fauna	Australasian bittern ('Threatened-Nationally Endangered' in Miskelly *et al*. 2008) and North Island fernbird ('At Risk-Declining' in Miskelly *et al*. 2008) are present in the site. Other species present include spotless crake ('At Risk-Relict' in Miskelly *et al*. 2008), pukeko and Australasian harrier hawk.
Discussion	This site contains a large, relatively good quality, representative example of the wetland vegetation of the Te Teko Ecological District. It forms a central part of a network of habitat islands of indigenous vegetation in the southern part of the ecological district. One threatened and one at risk bird species occur in the wetland.
Reference	Beadel *et al*. 1996b.

19: Lake Pupuwharau





Lake Pupuwharau (Part)[8]

Te Teko Natural Area No.	19
Grid Reference	NZMS260 V16 358393
Area	143.55 ha (within Te Teko Ecological District)
Landform Unit	Lake, wetlands, alluvial plains
Status	Unprotected
Recommended Area for Protection	Yes

BIOCLIMATIC ZONE	VEGETATION	LANDFORM
Semi-coastal	Te Teko Ecological District	
	1. Wetlands	
	• (Grey willow)/raupō-*Baumea articulata*-*Carex secta*-swamp kiokio reedland.	Wetland
	• Mānuka-grey willow forest and scrub.	Wetland
	• Mānuka-grey willow-*Baumea articulata*-*Baumea juncea*-raupō-swamp millet shrubland.	Wetland
	• *Baumea arthrophylla* sedgeland.	Wetland
	2. Lake and ponds (lakes and ponds are generally surrounded by a narrow margin of wetland vegetation) (in places too narrow to be shown on the attached maps).	Open water
	4. Mānuka Scrub	
	4a. Mānuka scrub (recently cleared).	Wetland
	4b. Grey willow locally common.	Wetland
	5. Raupō reedland, *Juncus acuminatus*-exotic grasses-beggars' ticks grass-rushland, water purslane (*Ludwigia palustris*)-*Myriophyllum propinquum*-*Lachnagrostis filiformis* herbfield.	Wetland
	8. Clearing.	Flat
	Kaingaroa Ecological District	
	3. Indigenous secondary forest, scrub, shrublands and fernlands (blackberry locally dominant).	
	• Kānuka forest.	Hillslope
	• Kānuka-mānuka scrub.	Flat
	• (Rewarewa)/kānuka-whauwhaupaku forest.	Hillslope
	• Kānuka/mānuka-whauwhaupaku (*Pseudopanax arboreus* var. *arboreus*)-(tutu (*Coriaria arborea*)) scrub.	Hillslope
	• Bracken fernland.	Hillslope
	• Koromiko (*Hebe stricta* var. *stricta*)-tutu-buddleia-bracken shrub-fernland.	Hillslope
	6. Japanese honeysuckle and blackberry vinelands.	Hillsope
	7. Privet-blackberry shrubland.	Flat
	(Beadel 1992b)	

Vegetation Described in Beadel (1992b&c).

8 Part of this natural area is in the Kaingaroa Ecological District.

Flora

Pimelea tomentosa occurs in the privet-blackberry shrubland. This species is classed as 'Threatened-Nationally Vulnerable' in de Lange *et al*. (2009). *Thelypteris confluens* and *Cyclosorus interruptus* occur around the margins of the lake; both species are classed as 'At Risk-Declining' in de Lange *et al*. (2009). *Utricularia australis* (classed as Threatened-Nationally Endangered in de Lange *et al*. 2009) was collected from the lake in 1963. Despite searching, no plants have been seen recently, however suitable habitat is present and *U. australis* may still be present. Severally regionally threatened plant species are present (*Tetraria capillaris, Epilobium chionanthum, Sparganium subglobosum*).

Four species in this wetland are not known to occur elsewhere in the ecological district: *Tetraria capillaris, Drosera binata,* and *Ranunculus amphitrichus*.

Epilobium chionanthum is known from only one site in the ecological district.

Baumea juncea occurs at this site. *B. juncea* is more commonly a coastal species, however it also occurs at several inland sites in the Te Teko and Rotorua Lakes Ecological Districts.

Fauna

Not known. Habitat present is suitable for common water bird and wetland bird species, including several threatened species. However, no information on fauna is available.

Discussion

The wetlands around the lake are not grazed and are in relatively good condition, with indigenous species dominant over much of the area.

The wetland contains the best known population of Thelypteris confluens in the Te Teko Ecological District. Cyclosorus interruptus is also present. It contains one of the last remaining examples of mānuka scrub in wetlands in the Te Teko Ecological District. The secondary vegetation on the hillslopes around the lake (in the Kaingaroa Ecological District) provides a protective buffer to the lake and associated wetland vegetation. Wetland vegetation now comprises only c. 2.4% of their former extent in the Te Teko Ecological District, and indigenous vegetation cover has been reduced to about 5% of the total land cover in the Kaingaroa Ecological District. This highlights the conservation values of all remaining indigenous vegetation in these ecological districts.

This site contains one of only three examples of thermal vegetation in the ecological district. Thermal vegetation may have formerly been more extensive prior to development of the Kawerau field.

This site is part of a disjunct network of indigenous vegetation wildlife habitat that is present around the margins of the Te Teko alluvial plain, where it adjoins hill country.

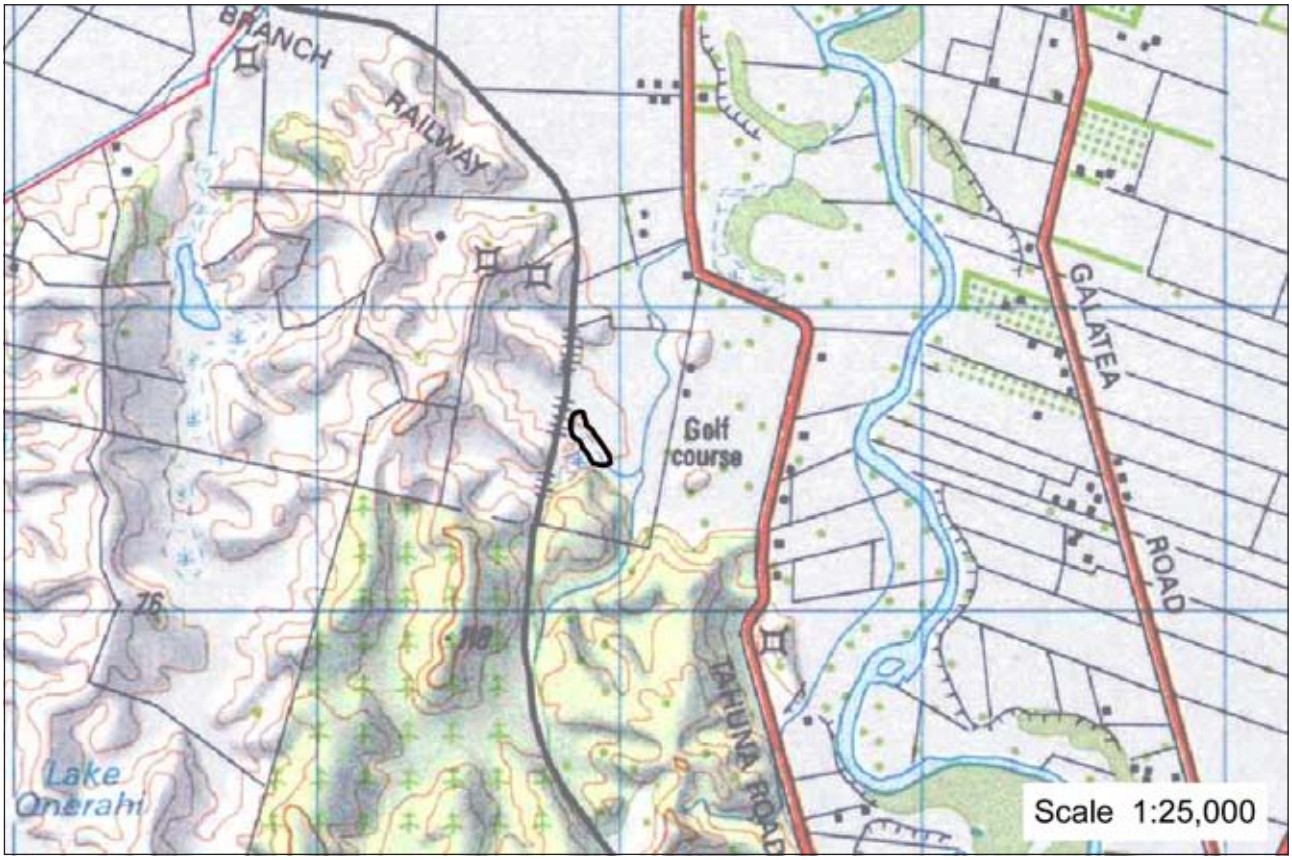
Notes

Areas dominated by blackberry and privet, contiguous to this natural area (along northern margins) have not been included because of the predominance of naturalised species. This site is currently undergoing a restoration programme.

References

Beadel 1992b & c.

20: Eivers' Wetland



Eivers' Wetland

Te Teko Natural Area No. 20
Grid Reference NZMS260 V15 428425
Area 1.06 ha
Landform Unit Alluvial plain
Status Unprotected
Recommended Area for Protection Yes

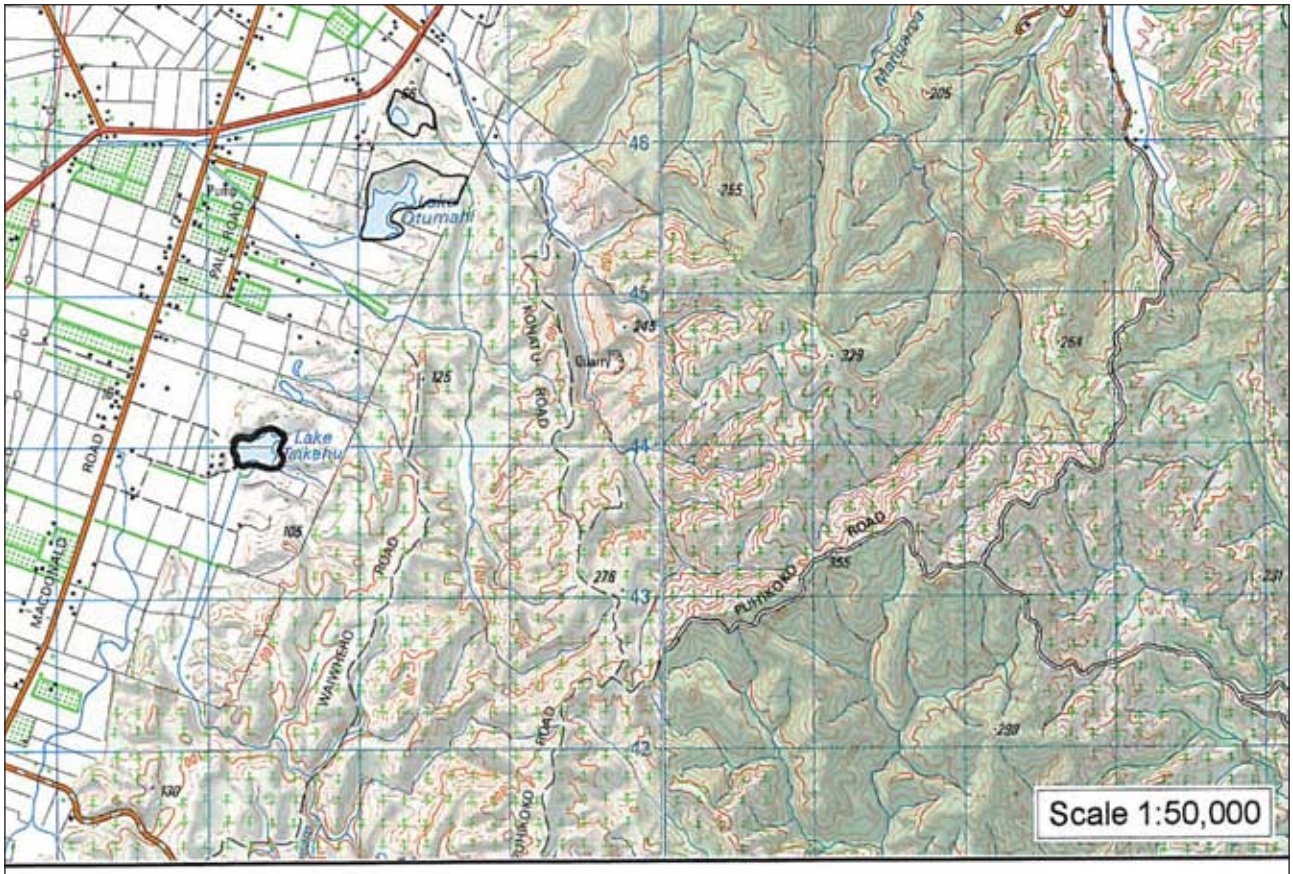
BIOCLIMATIC ZONE	VEGETATION	LANDFORM
Semi-coastal	• Raupō reedland.	Wetland
	• *Carex secta-Baumea articulata*-(raupō) reedland.	Wetland
	• (Grey willow)/*Juncus effusus* rushland.	Wetland margins
	• *Azolla pinnata* herbfield.	Open water

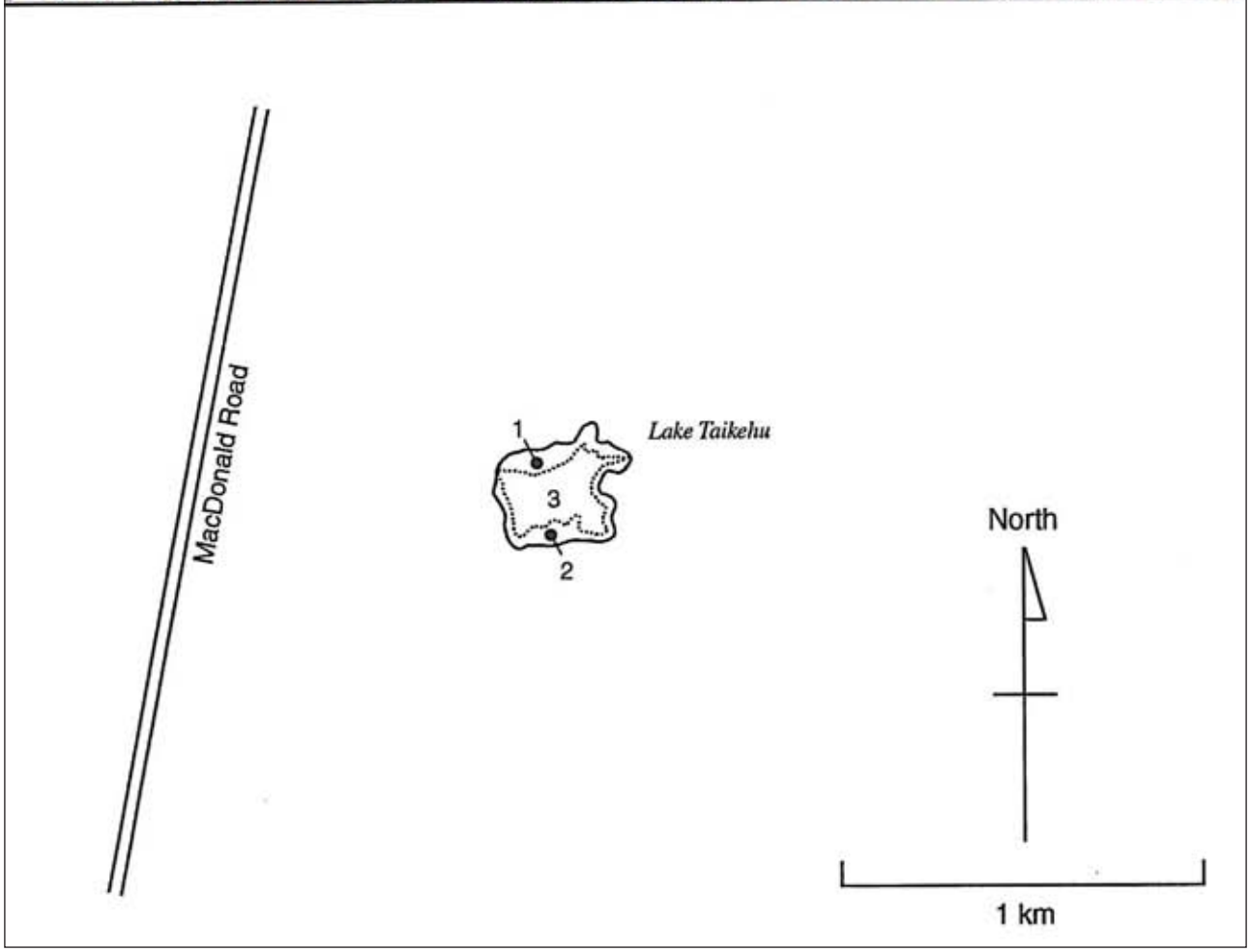
Vegetation Dense reedland occurs in the central part of the wetland, which is dominated by raupō, *Carex secta* and *Baumea articulata*. A small area of open water is dominated by *Azolla pinnata*. The margins of the wetland are dominated by a rushland of *Juncus effusus* in association with *Carex secta*, *Juncus edgariae* and scattered, emergent grey willow.

Flora and Fauna No significant species were recorded during this survey.

Discussion Wetland vegetation once covered much of the Te Teko Ecological District, however now only about 2.4% remains of the original *c.* 27,500 ha. So although this site is relatively small and modified, it is still of ecological significance.

21: Lake Taikehu





Lake Taikehu

Te Teko Natural Area No. 21
Grid Reference NZMS260 V15 474440
Area 4.49 ha
Landform Unit Lake/pond, wetland, alluvial plain
Status Unprotected
Recommended Area for Protection Yes

BIOCLIMATIC ZONE	VEGETATION	LANDFORM
Semi-coastal	1. Crack willow forest.	Wetland margins
	2. Raupō reedland ⇔ *Juncus effusus* tussockland.	Wetland margins
	3. Open water.	Pond

Vegetation This site is predominantly open water. Crack willow forest dominates the northern side of the lake, and a raupō reedland, with scattered clumps of giant spike sedge forms the vegetation on the southern side. Tussockland of *Juncus effusus* forms a buffer between the reedland and pasture.

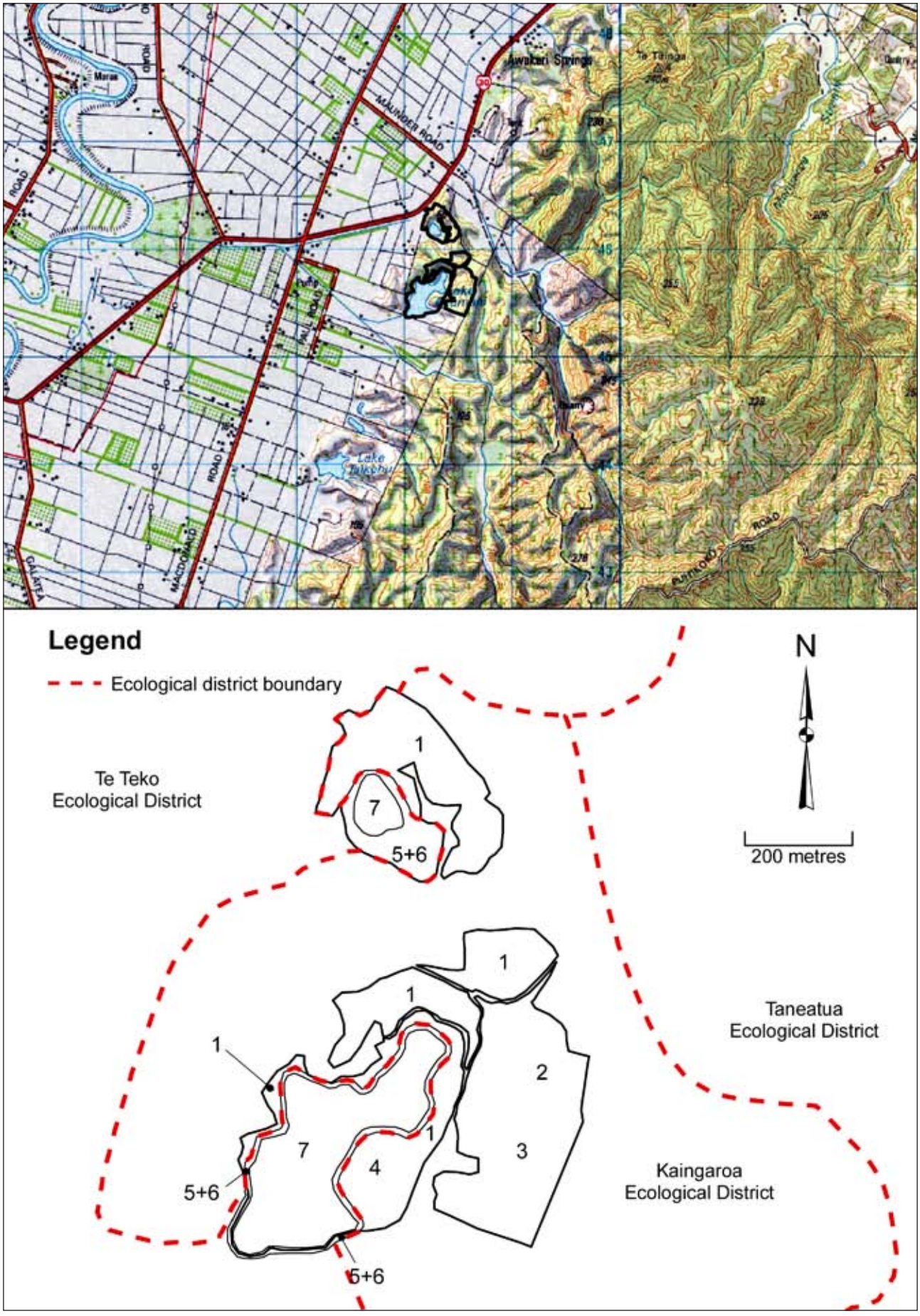
Flora No significant species were recorded during this survey.

Fauna New Zealand dabchick (Threatened-Nationally Vulnerable in Miskelly *et al*. 2008) are present. Other species recorded include New Zealand scaup, spotless crake ('At Risk-Relict' in Miskelly *et al*. 2008), black shag, kingfisher, mallard duck, paradise shelduck, pukeko, spur-winged plover, welcome swallow and white faced heron.

Discussion The site forms part of a chain of habitat islands for wildlife species around the margins of the Te Teko alluvial plain. Large numbers of water fowl utilise the lake, and one significant bird species was recorded.

Wetland vegetation has been greatly reduced in extent in the Te Teko Ecological District since 1840, and although this site is relatively small and modified, it comprises one of the few remaining examples of wetland vegetation.

22: Lake Otumahi



Lake Otumahi (Part)[9]

Te Teko Natural Area No. 22
Grid Reference NZMS260 V15 482462, V15 482455
Area 32.13 ha
Landform Unit Lake, wetland, alluvial plain (in Te Teko Ecological District)
Status Unprotected
Recommended Area for Protection Yes

BIOCLIMATIC ZONE	VEGETATION	LANDFORM
Semi-coastal	**Kaingaroa Ecological District**	
	1. (Radiata pine)/kānuka forest.	Hillslope
	2. Kānuka-mamaku-(kāmahi) forest.	Hillslope and gully
	3. (Radiata pine)/mānuka-mingimingi shrubland.	Hillslope and topslope
	4. Kānuka-barberry-blackberry-mānuka shrubland.	Hillslope and topslope
Semi-coastal	**Te Teko Ecological District**	
	5. Grey willow/mānuka scrub ⇔ raupō reedland.	Lake margin
	6. Mānuka scrub ⇔ raupō reedland ⇔ giant spike sedge reedland.	Lake margin
	7. Open water.	Lake

Vegetation

The vegetation on this site is diverse, reflecting a long history of repeated clearance. Some hillsides are dominated by kānuka forest with scattered gorse and occasional emergent radiata pine. A few examples of emergent rewarewa, whauwhaupaku, and pole-sized rimu (*Dacrydium cupressinum*) occur in this vegetation type. In the gully, the forest is dominated by kānuka and mamaku, with occasional kāmahi. On slopes above the gully, a shrubland of mānuka and mingimingi occurs. Karamū, tutu, tī kōuka, and ti ngahere (*Cordyline banksii*) are scattered throughout.

The margins of the northern lake are dominated by mānuka scrub, with occasional grey willow. Local raupō and giant spike sedge reedlands occur along the lacustrine margin in open water.

The margins of the southern lake are dominated by grey willow over mānuka scrub. Local examples of raupō reedland are also present in open water along the lacustrine margin.

Flora

No significant plant species were noted at this site during the survey.

Fauna

New Zealand dabchick (Threatened-Nationally Vulnerable in Miskelly *et al*. 2008) occurs at this site. Other species noted include grey warbler, mallard duck, pukeko and pheasant.

9 Part of this site lies in Kaingaroa Ecological District.

Discussion	This site straddles two ecological districts, and has palustrine, lacustrine and terrestrial ecosystems, giving it a high species diversity. Wetland vegetation cover has been greatly reduced in the Te Teko Ecological District to about 2.4% of its extent in 1840. Although this site is relatively small and modified, it comprises one of the few remaining examples of wetland vegetation, and a threatened bird species (dabchick) occurs at this site.
References	Beadel 1992d.

23: Tītoki


Substation
Marae
Pahou
Quarry
PAHOU PA ROAD
MASON RD
STATION ROAD
Waioho Stream
REWATU ROAD
TITOKI ROAD
White Pine Bush
ERNEST RD
BURR ROAD
Rewatu Marae
UTLER ROAD
Scale 1:25,000

Tītoki

Te Teko Natural Area No.	23
Grid Reference	NZMS260 W15 590492
Area	1.34 ha
Landform Unit	Alluvial plain
Status	Unprotected
Recommended Area for Protection	Yes

BIOCLIMATIC ZONE	VEGETATION	LANDFORM
Semi-coastal	(Kahikatea)/tītoki-pukatea (*Laurelia novae-zelandiae*)-kahikatea forest.	Flood plain

Vegetation

Tītoki, pukatea and kahikatea form the canopy, in association with occasional turepo (*Streblus heterophyllus*), porokaiwhiri (*Hedycarya arborea*), and māhoe. Cattle have heavily depleted the understorey, which now comprises scattered naturalised species, including barberry and hawthorn (*Crataegus monogyna*).

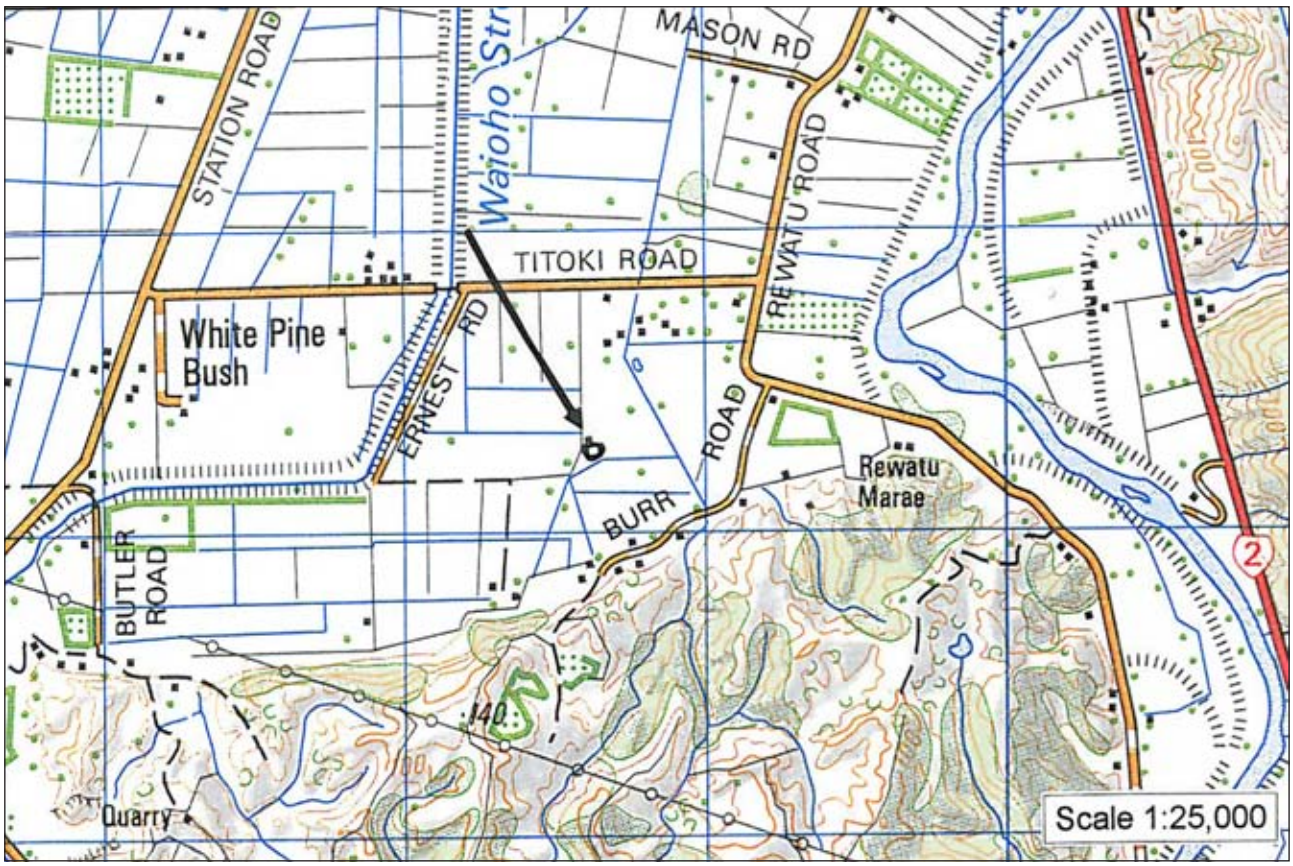
Flora and Fauna

No significant flora or fauna were noted at this site during the survey.

Discussion

Although small, this is the only one of two examples of tall indigenous forest remaining in the Te Teko Ecological District, and therefore is of significant conservation value. Although extensive grazing has removed the understorey, regeneration at the site would occur if it was fenced to exclude grazing animals. Seedlings of kahikatea are locally common in the site.

24: Ernest Pukatea



Ernest Pukatea

Te Teko Natural Area No.	24
Area	0.24 ha
Grid Reference	NZMS260 W15 586483
Landform Unit	Alluvial plain
Status	Unprotected
Recommended Area for Protection	Yes

BIOCLIMATIC ZONE	VEGETATION	LANDFORM
Semi-coastal	• Pukatea-kahikatea forest (with scattered tawa (*Beilschmiedia tawa*) and one ti kouka; understorey is dominated by privet, tītoki, pukatea, planted indigenous species, including puriri (*Vitex lucens*), kauri (*Agathis australis*), matai, tōtara, and miro; tradescantia dominates the ground cover).	Flood plain

Vegetation Small remnant example of swamp forest.

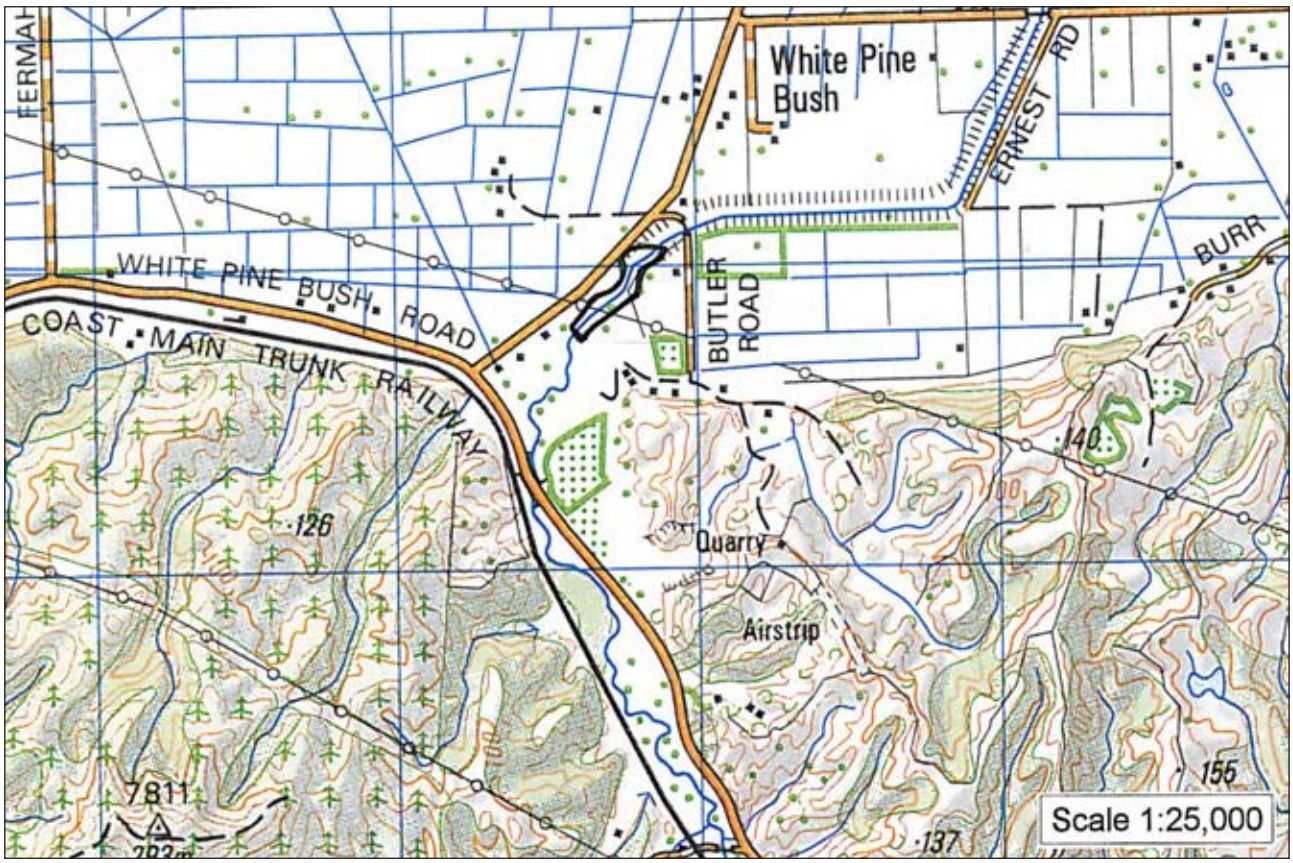
Flora Species present include tītoki, kawakawa (*Macropiper excelsum* var. *excelsum*), māpou (*Myrsine australis*), and *Muehlenbeckia australis*. An interesting feature of this site is the presence of several large *Griselina lucida* trees.

Fauna Kererū utilise this remnant.

Threat/Modification This area has been fenced to exclude grazing animals for about 10-15 years. However the understorey was recently sprayed with glyphosate by owners to eliminate a vine. This area is likely to require a high level of management in the long term to maintain it.

Discussion Although this area is very small and highly modified, it is one of only two remaining examples of swamp forest on the Rangitaiki Plains.

25: Waioho Kahikatea



Waioho Kahikatea

Te Teko Natural Area No. 25
Area 1.17 ha
Grid Reference NZMS260 W15 568480
Landform Unit Alluvial plain
Status Unprotected
Recommended Area for Protection Yes

BIOCLIMATIC ZONE	VEGETATION	LANDFORM
Semi-coastal	• Kahikatea treeland (with local radiata pine (shelter belt plantings), crack willow, kānuka, and mamaku; understorey is mainly naturalised grasses and herbs - creeping buttercup (*Ranunculus repens*), ryegrass (*Lolium perenne*), cocksfoot (*Dactylis glomerata*), cleavers (*Galium aparine*), inkweed, meadow rice grass (*Microlaena stipoides*), blackberry, tradescantia, and privet).	Alluvial stream terrace

Vegetation Remnant trees of secondary kahikatea stand which established following clearance of the original vegetation cover on the plains.

Flora Taxa present include tawa, pukatea, tī kōuka, mamaku, kānuka, and māpou.

Fauna Species present include tūī (*Prosthemadera novaeseelandiae*) and fantail. Kererū probably use this area.

Threat/Modification This area is currently grazed. Part of this area is likely to be included in an esplanade reserve following subdivision. To maintain and improve this area in the long term would require a high management input.

Discussion Little of Te Teko Ecological District remains in indigenous vegetation cover. This site comprises the only example of secondary kahikatea treeland in the ecological district. This site comprises a small remnant example with a discontinuous canopy.

26: Thornton Road Dunes

Thornton Road Dunes

Te Teko Natural Area No. 26
Grid Reference NZMS260 V15 454606
Area 30.28 ha
Landform Unit Sand dunes
Status Sand dunes (Western Whakatane Coastal Recreation Reserves)
Recommended Area for Protection Yes

BIOCLIMATIC ZONE	VEGETATION	LANDFORM
Coastal	• (Boxthorn)/Indian doab-ratstail-yarrow grassland.	Sand dune
Coastal	• (Boxthorn)-(sweet brier)/kikuyu grassland.	Sand dune
	(Gosling and Beadel 2000a)	

Vegetation This area is dominated by exotic vegetation, including some well-established pest plants (e.g. boxthorn, exotic grasses, sheep's sorrel, wild carrot, lupin, sweet brier, blackberry, and pampas).

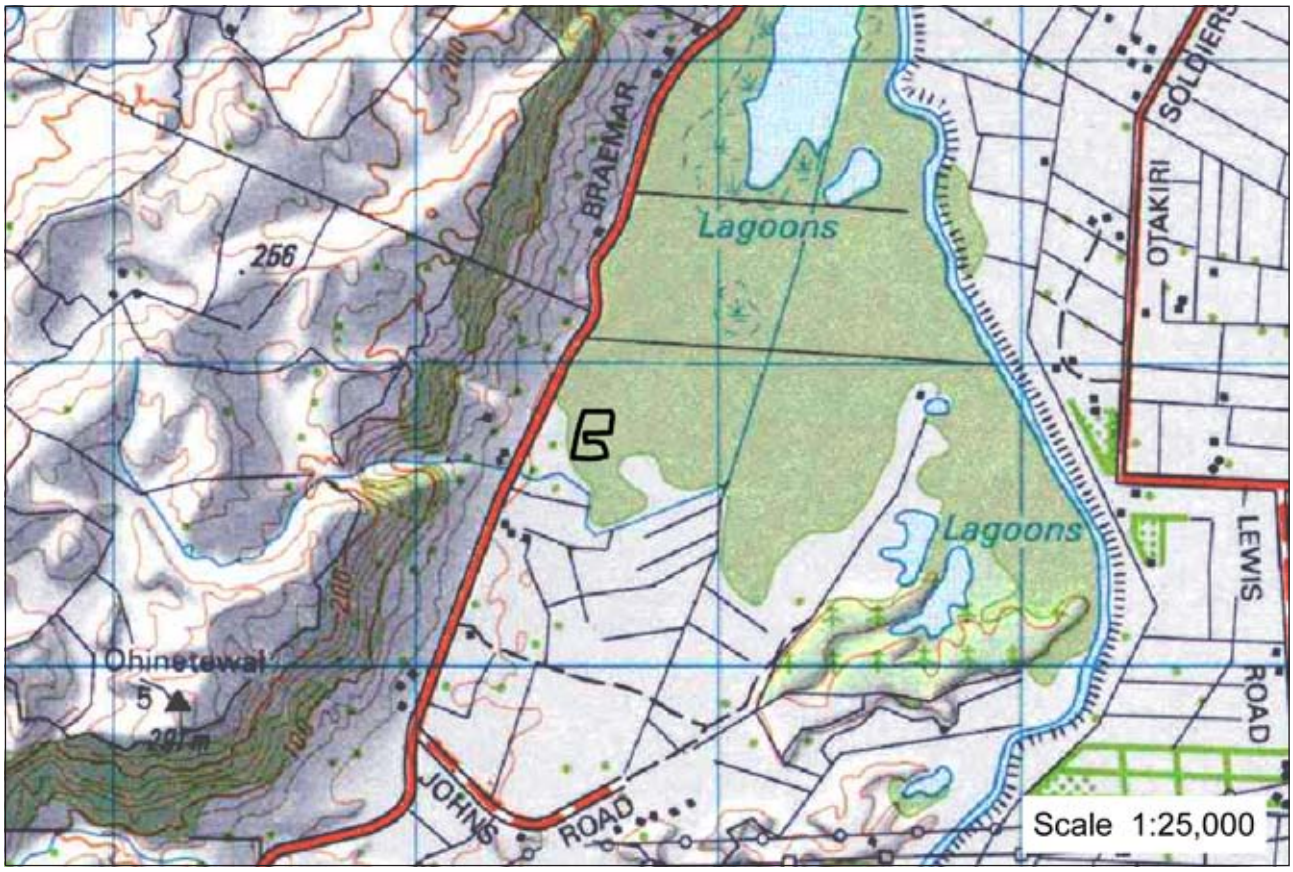
Flora and Fauna No significant species recorded.

Discussion This site, although dominated by exotic plant species, is of local ecological significance as a protective buffer to the less modified, nationally significant dunelands to which it is adjacent (SVHZ-115: Otamarakau-Matata-Whakatane Dunes). If grazing was removed, this site would revert to indigenous vegetation with a low level of management input (including timely weed control).

Notes Coastal dunes are a threatened habitat and have been identified as a national priority for the protection of biodiversity on private land (MfE and DOC 2007).

References Gosling and Beadel 2000a.

27: Braemar Road B



Braemar Road B

Te Teko Natural Area No. 27
Area 1.36 ha
Grid Reference NZMS260 V15 376509
Landform Unit Wetland
Status Unprotected
Recommended Area for Protection Yes

BIOCLIMATIC ZONE	VEGETATION	LANDFORM
Semi-coastal	• Grey willow-mānuka-harakeke-pampas-blackberry shrubland.	Wetland

Vegetation Small example of wetland vegetation modified by grazing and clearance of drainage.

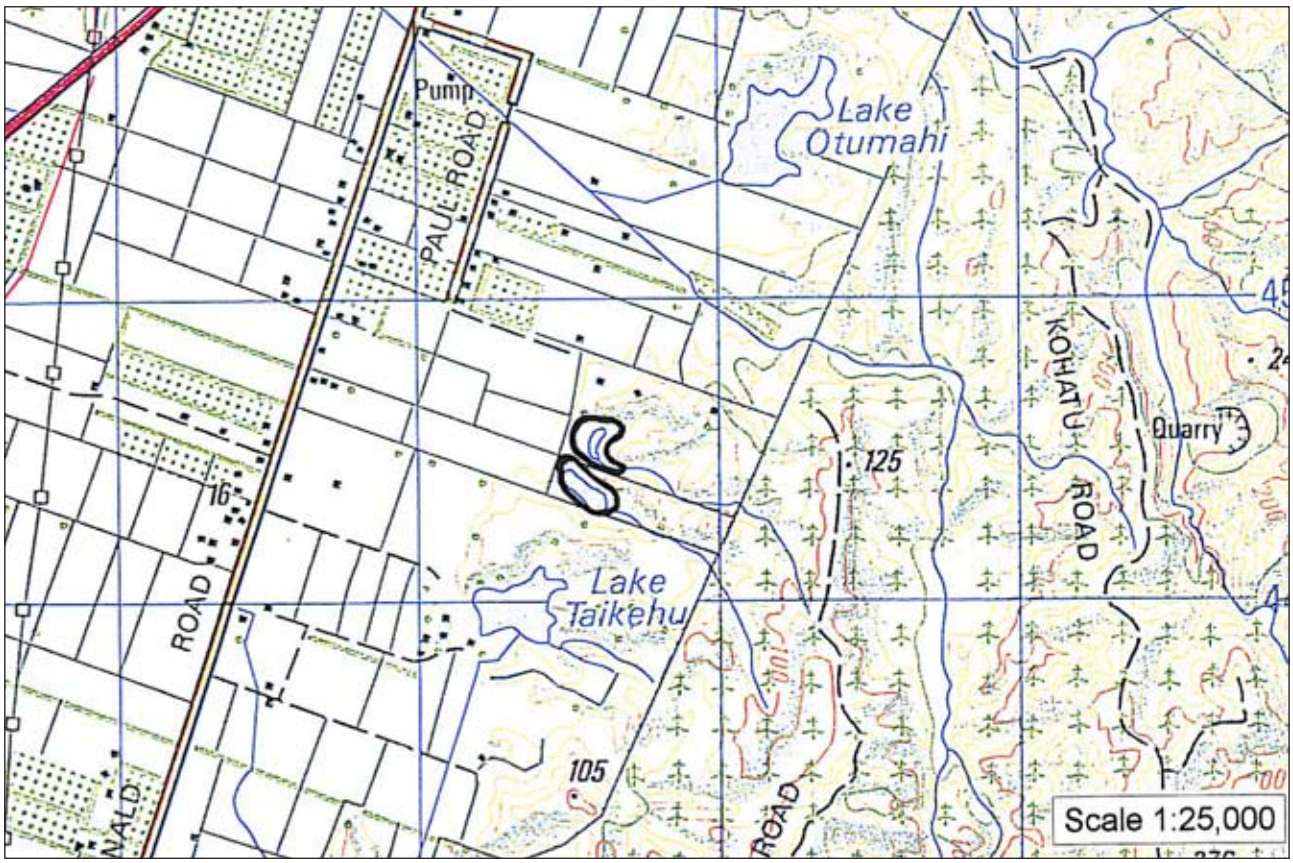
Flora One pole rimu occurs in this site.

Fauna North Island fernbird ('At Risk-Declining' in Miskelly *et al.* 2008) and spotless crake ('At Risk-Relict' in Miskelly *et al.* 2008) occur in the nearby Tumurau Lagoon covenant and may use this area.

Threat/Modification This area is partially drained and cleared; and is grazed.

Discussion Although small, highly modified, and degraded, this wetland is near a relatively large wetland (Tumurau) of signficant conservation value. Only about 2.4% of the extensive wetlands (*c.* 27,500 ha) that once covered the Rangitaiki Plains remain.

28: Needham Ponds



Needham Ponds

Te Teko Natural Area No.	28
Area	1.83 ha
Grid Reference	NZMS260 V15 475444
Landform Unit	Wetland
Status	Unprotected
Recommended Area for Protection	Yes

BIOCLIMATIC ZONE	VEGETATION	LANDFORM
Semi-coastal	**Northern pond margins**	
	• *Carex secta* sedgeland (with local raupō and a few scattered emergent crack willow).	Wetland
	Southern pond margins	
	• *Carex secta* sedgeland (with scattered grey willow, crack willow and weeping willow (*Salix babylonica*).	Wetland

Vegetation Wetland vegetation modified by clearance and grazing.

Flora Species present include swamp millet, *Carex maorica*, mānuka, *Schoenoplectus tabernaemontani, Myriophyllum propinquum*, and *Persicaria decipiens*.

Fauna Pukeko, kingfisher and white-faced heron were recorded.

Threat/Modification These areas are grazed to the water's margins; the owner is planning to clear to the edge of the ponds and establish grass to provide suitable duck habitat. Water lilies (*Nymphaea* sp.) are present.

Discussion Wetland vegetation has been dramatically reduced in extent in the ecological district which highlights the significance of any remaining wetland. This site comprises a small example of wetland vegetation around pond margins.

29: Orini Stream

Orini Stream

Te Teko Natural Area No.	29
Area	4.49 ha
Grid Reference	NZMS260 W15 581553; 577556
Landform Unit	Alluvial plain
Status	Unprotected
Recommended Area for Protection	Yes

BIOCLIMATIC ZONE	VEGETATION	LANDFORM
Coastal	• Raupō reedland (raupō abundant, with scattered crack willow, *Carex secta*, *Persicarea decipiens* and local *Bolboschoenus fluviatilis*). (75%)	Wetland
	• Duckweed herbfield (dense cover of duckweed). (20%)	Wetland
	• Open water. (5%)	Wetland

Vegetation Vegetation has established in the Orini Stream channel when the natural water floor was diverted to an artificial canal.

Flora Species present include tī kōuka, *Schoenoplectus tabernaemontani, Coprosma propinqua* subsp. *propinqua* × *C. robusta, Lobelia angulata, Eleocharis acuta,* and *Muehlenbeckia complexa*.

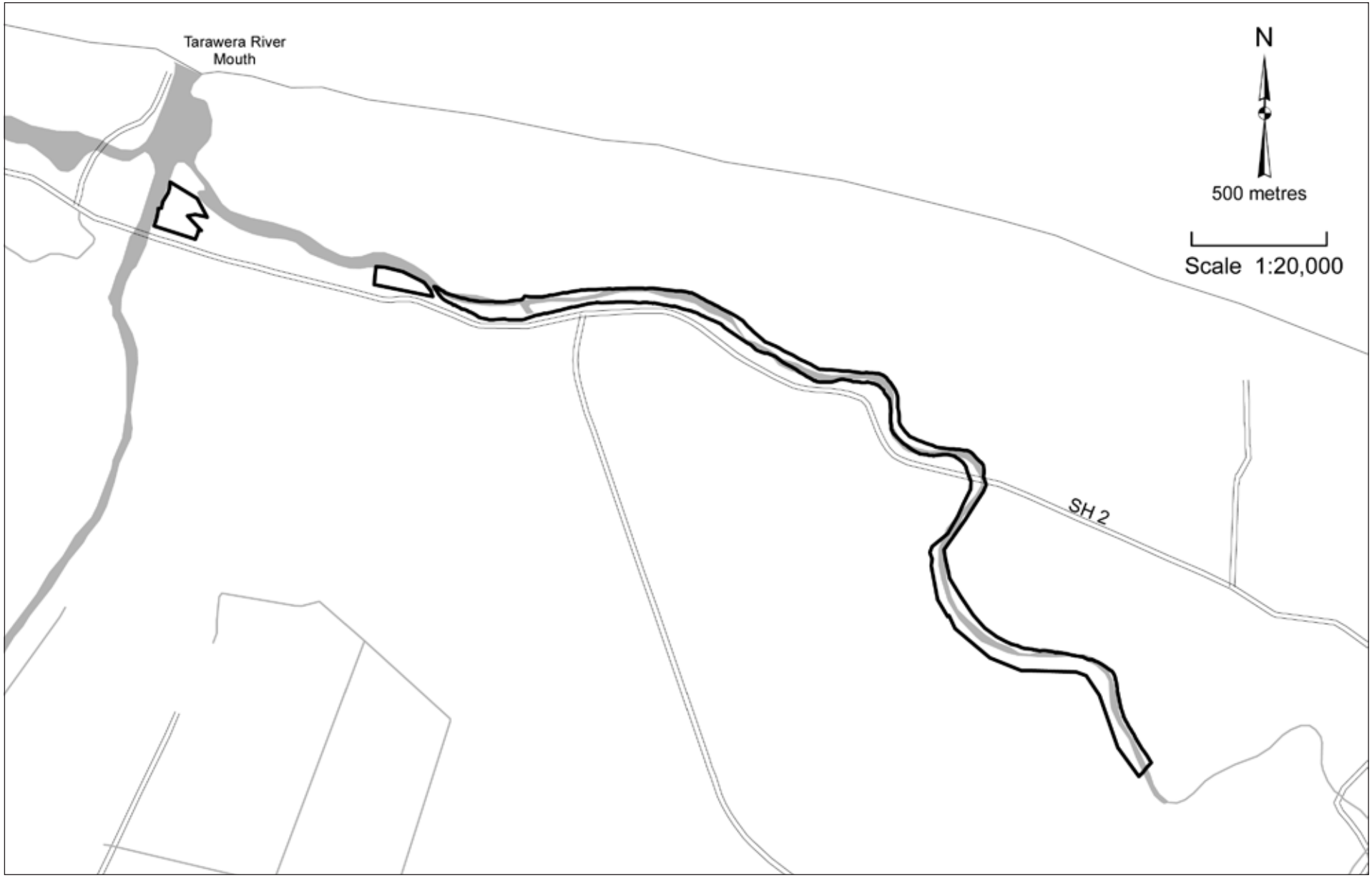
Fauna Pukeko and mallard present. This area contains suitable habitat for crake.

Threat/Modification This area is currently grazed. It should be fenced to exclude grazing. The area is predominantly indigenous with a few scattered grey and crack willow.

Discussion Although small, this area is one of the few remaining examples of indigenous vegetation in the ecological district. Less than six percent of the Ecological District remains in indigenous vegetation cover.

30 - 1: Old Rangitaiki Stewardship Area (Old Rangitaiki River Channel)

30 - 2: Old Rangitaiki Stewardship Area (Old Rangitaiki River Channel)



Old Rangitaiki Stewardship Area (Old Rangitaiki River channel)

Te Teko Natural Area No. 30
Area 24.34 ha
Grid Reference NZMS260 V15 605434
Landform Unit Wetland, alluvial plains, rivers
Status Protected

BIOCLIMATIC ZONE	VEGETATION	LANDFORM
Coastal and semi-coastal	• Rank pasture (species present include Scotch thistle (*Cirsium vulgare*), paspalum and kikuyu are common with scattered brome (*Bromus* sp.), *Lepidium* sp., Californian thistle (*Cirsium arvense*) and *Calystegia sepium*.	Flat
	• Open water.	River channel
	• Harakeke/*Muehlenbeckia complexa*-tall fescue flaxland.	Wetland
	• Raupō reedland (with a few examples of tī kōuka, *Bolboschoenus medianus* sedgeland.	Wetland
	• Reed sweetgrass grassland.	Wetland

Vegetation Predominantly rank pasture (parts of which have been planted with kānuka and mānuka) with a few remnant examples of wetland vegetation. The areas of rank pasture are all within the "Old Rangitaiki Stewardship Area".

Flora Taxa present include bachelor's button and arrow grass.

Fauna Wetland bird species utilise this area, including pukeko. Contains suitable habitat for whitebait spawning, however whitebait spawning sites have not been observed in the reserve.

Threat/Modification Kānuka and mānuka have been planted in the parts of Old Rangitaiki Stewardship Area, which has not been grazed for ten years.

Discussion These reserves contain a few remnant examples of wetland vegetation, the areas dominated by exotic vegetation offer excellent opportunities for restoration.

31: Tarawera River Willow Forest

Tarawera River Willow Forest

Te Teko Natural Area No.	31
Area	3.54 ha
Grid Reference	NZMS260 V15 410552
Landform Unit	Wetland
Status	Unprotected
Recommended Area for Protection	Yes

BIOCLIMATIC ZONE	VEGETATION	LANDFORM
Semi-coastal	• Grey willow forest (with occasional tī kōuka and crack willow; the understorey is variable and includes karamū, whekī, privet and *Coprosma propinqua* subsp. *propinqua*; the shrub tier is diverse with harakeke, *Carex* sp. (*C. geminata* agg.), *Carex virgata, Schoenoplectus tabernaemontani, Juncus effusus, Baumea juncea, Baumea rubiginosa*, and black nightshade (*Solanum nigrum*) common; ground cover comprises mainly pasture grasses and herbs including Yorkshire fog, ryegrass, forget-me-not, and beggars' ticks, with occasional *Hypolepis distans* and swamp kiokio).	Wetland

Vegetation Narrow strip of wetland vegetation modified by establishment of grey willow following disturbance.

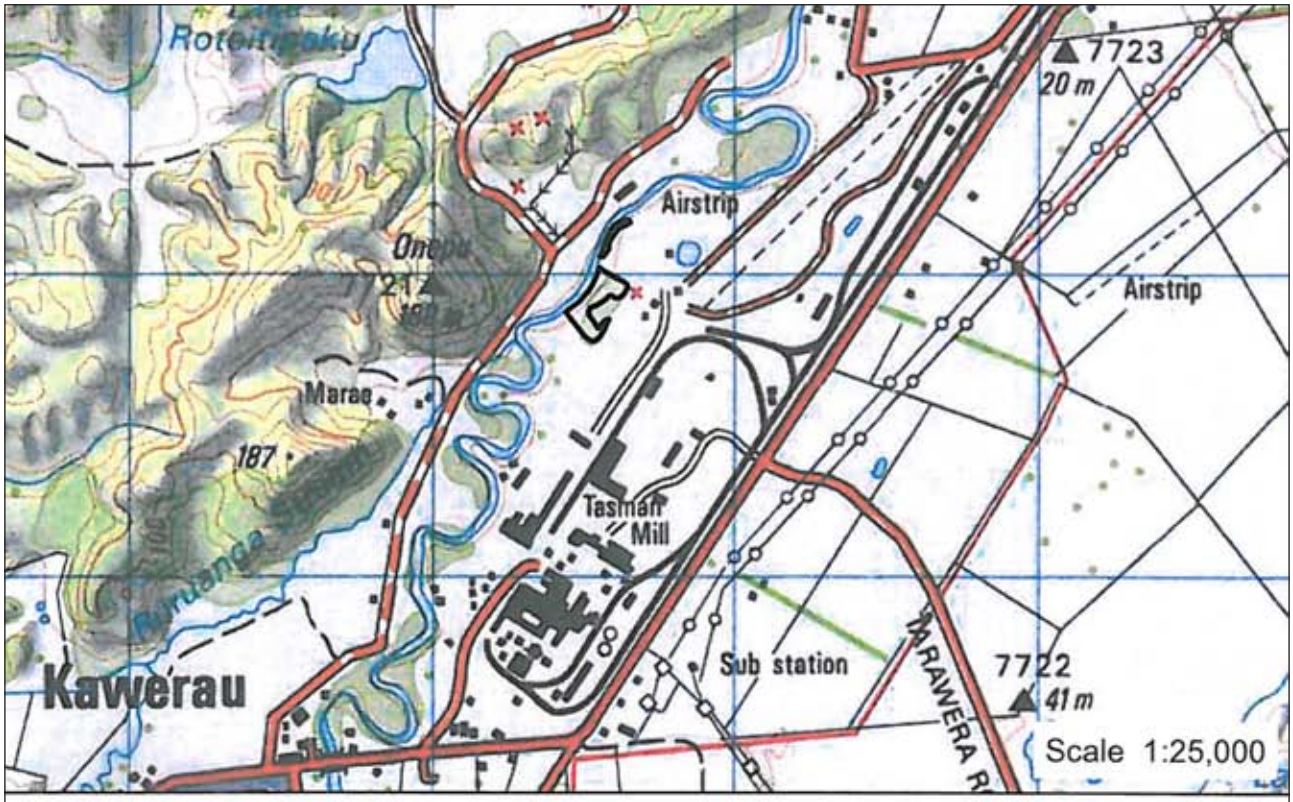
Flora Taxa present include *Hypolepis distans, Baumea rubiginosa,* and *Baumea juncea*. *Hypolepis distans* is a regionally uncommon species.

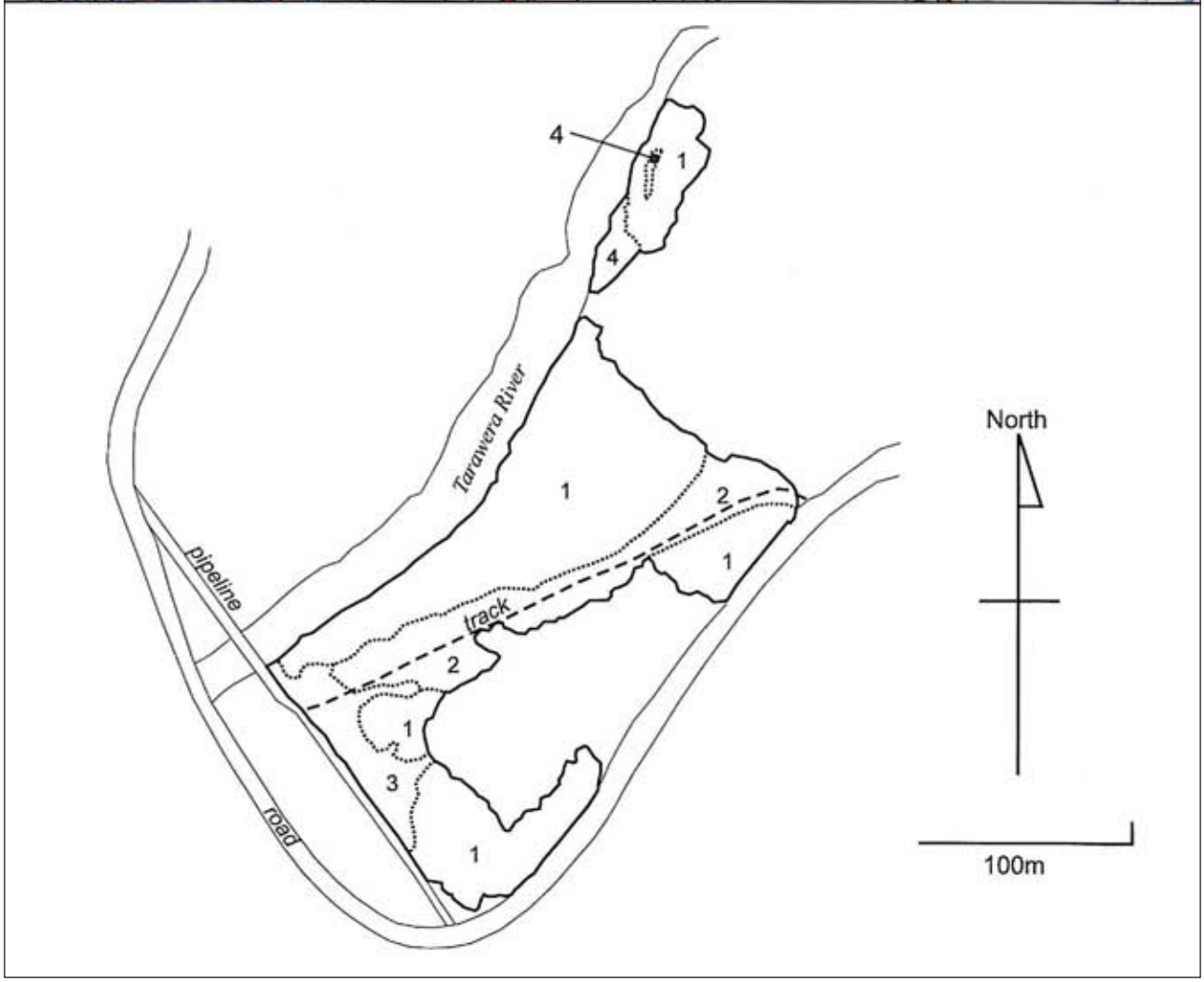
Fauna Birds present include Australasian bittern ('Threatened-Nationally Endangered' in Miskelly *et al*. 2008), pukeko, and black shag.

Threat/Modification Grey willow has established in this site. It is heavily grazed. A drain has been constructed parallel to the wetland which has resulted in lower water levels.

Discussion This site contains a small example of wetland vegetation. A small area of wetland vegetation in an ecological district where very little vegetation remains. It provides habitat for a nationally endangered bird species.

32: Tarawera River Kānuka





Tarawera River Kānuka

Te Teko Natural Area No. 32
Grid Reference: NZMS260 V15 365418
Area: 2.12 ha
Landform Unit: Alluvial plain
Status: Unprotected
Recommended Area for Protection Yes

BIOCLIMATIC ZONE	VEGETATION		LANDFORM
Semi-coastal	1.	Kānuka forest.	River terrace
Semi-coastal	2.	Kānuka shrubland.	River terrace
Semi-coastal	3.	Buddleia-pampas-privet-blackberry shrubland with areas of bare soil also present.	River terrace
Semi-coastal	4.	Geothermal moss and rockland.	River terrace

Vegetation Modification and Threats: An area of kānuka forest and shrubland adjacent to the Tarawera River. A small area of geothermally heated rocks and soil occurs on the margin of the site.

Flora: No significant taxa recorded.

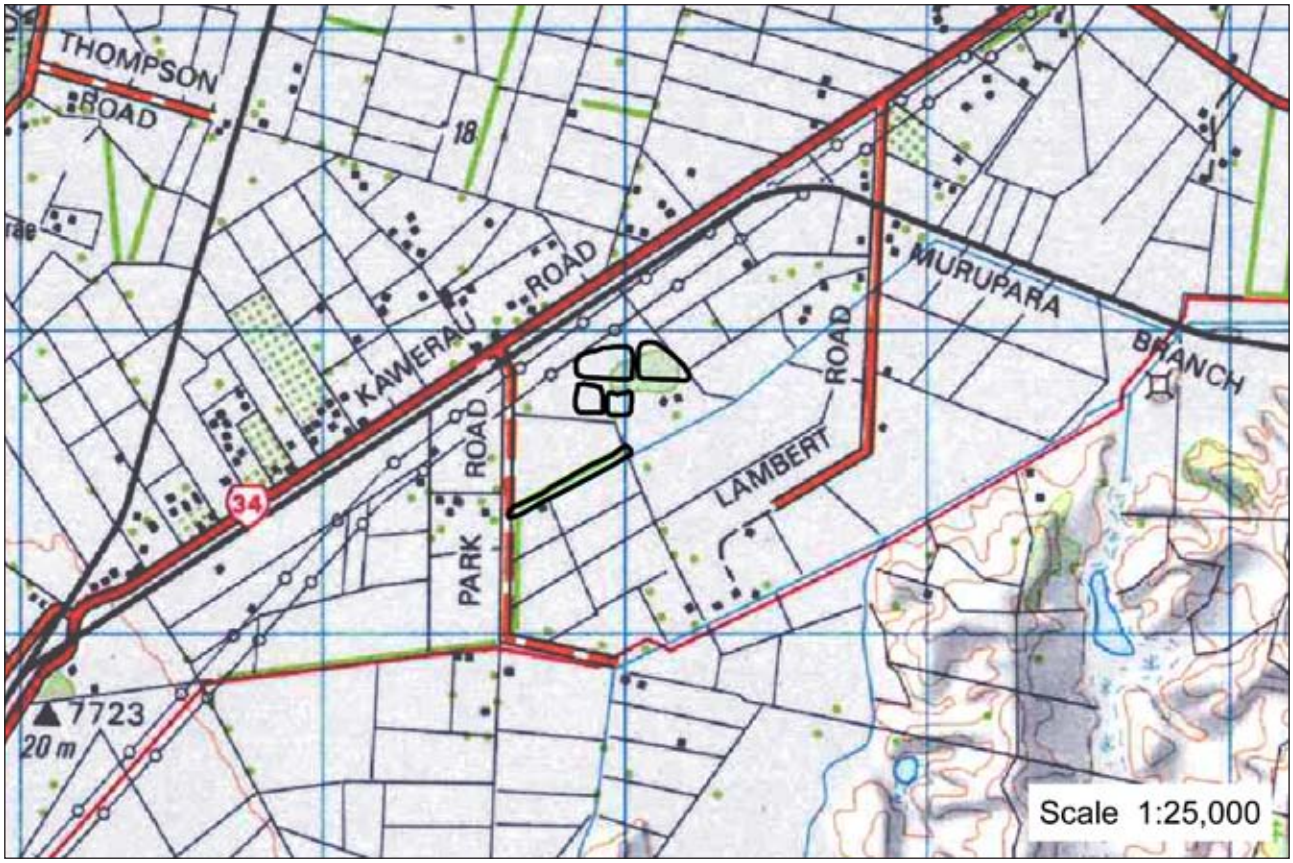
Fauna: No data available.

Threat/modification: The vegetation occurs on an industrial site and has a little used road passing through it. Weeds are common on the margins and, in places, under the kānuka canopy.

Justification: Although the site is small and degraded, the very small proportion of indigenous vegetation and habitats remaining in the ecological district means that all remaining indigenous vegetation has a conservation value. This is one of only four small areas of kānuka forest within the ecological district.

Notes: This is the best example of kānuka forest on alluvial plains remaining in the ecological district. This site also contains one of only three areas of geothermal activity in the ecological district.

33: Park Road Kānuka



Park Road Kānuka

Te Teko Natural Area No.	33
Area	6.01 ha
Grid Reference	NZMS260 V15 400438
Landform Unit	Alluvial plain
Status	Unprotected
Recommended Area for Protection	Yes

BIOCLIMATIC ZONE	VEGETATION	LANDFORM
Semi-coastal	• Kānuka forest (understorey dominated by naturalised species including barberry and gorse with scattered mingimingi and kānuka seedlings, broom, Spanish heath, *Pomaderris amoena*).	Alluvial plain

Vegetation Remnant kānuka forest which established about 40–50 years ago on Tarawera Ash following clearance of the original vegetation.

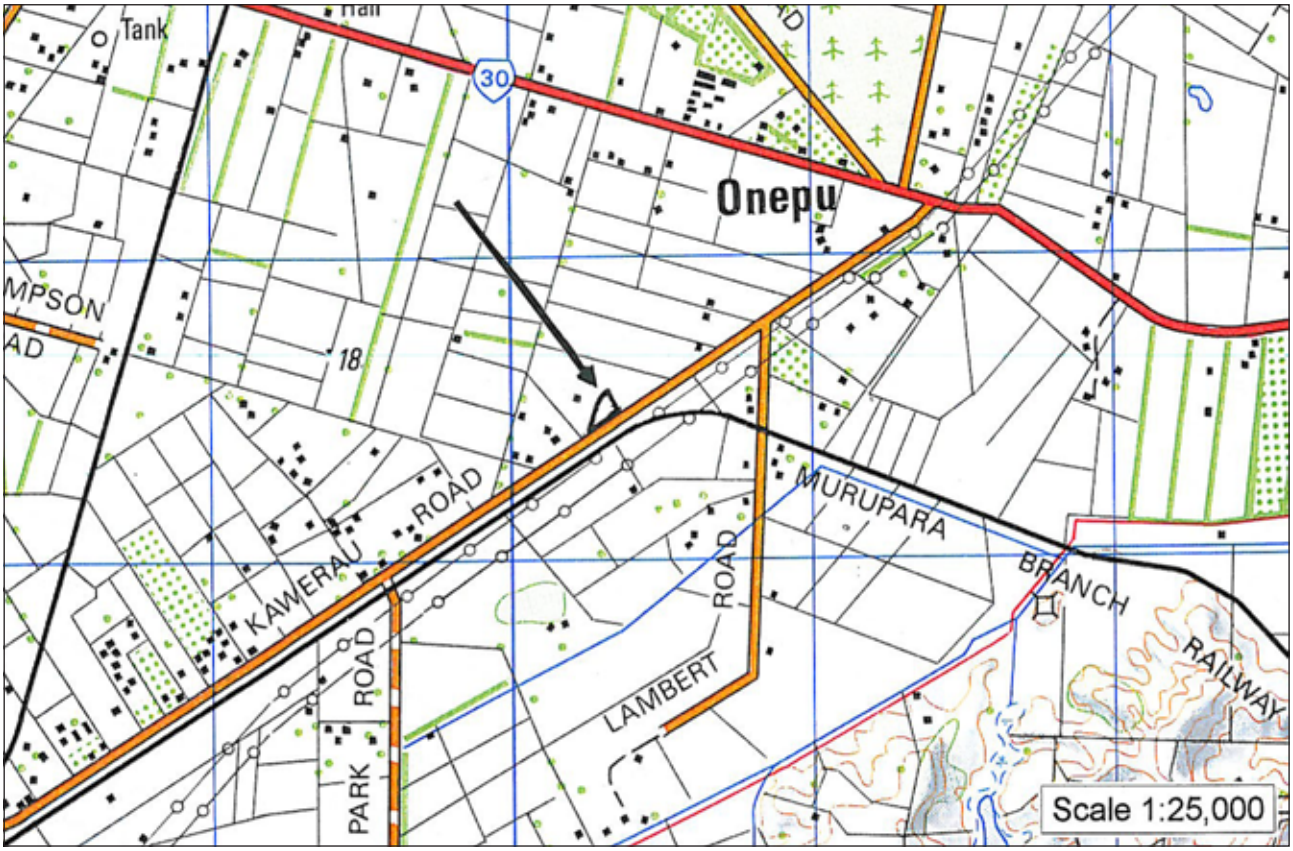
Flora No significant plant species have been recorded from this site.

Fauna Common field birds present.

Threat/Modification Naturalised species are common at this site. It is lightly grazed. The areas of kānuka should be fenced and stock excluded.

Discussion Whilst this natural area is relatively small, however it comprises one of only four areas of kānuka forest remaining on the plains. Very little indigenous vegetation remains in the ecological district, which highlights the significance of any remaining areas.

34: Kawerau Road Kānuka



Kawerau Road Kānuka

Te Teko Natural Area No.	34
Area	0.50 ha
Grid Reference	NZMS260 V15 404444
Landform Unit	Alluvial plains
Status	Unprotected
Recommended Area for Protection	Yes

BIOCLIMATIC ZONE	VEGETATION	LANDFORM
Semi-coastal	• Kānuka forest (privet and barberry dominate the understorey with occasional mingimingi present).	Alluvial plain

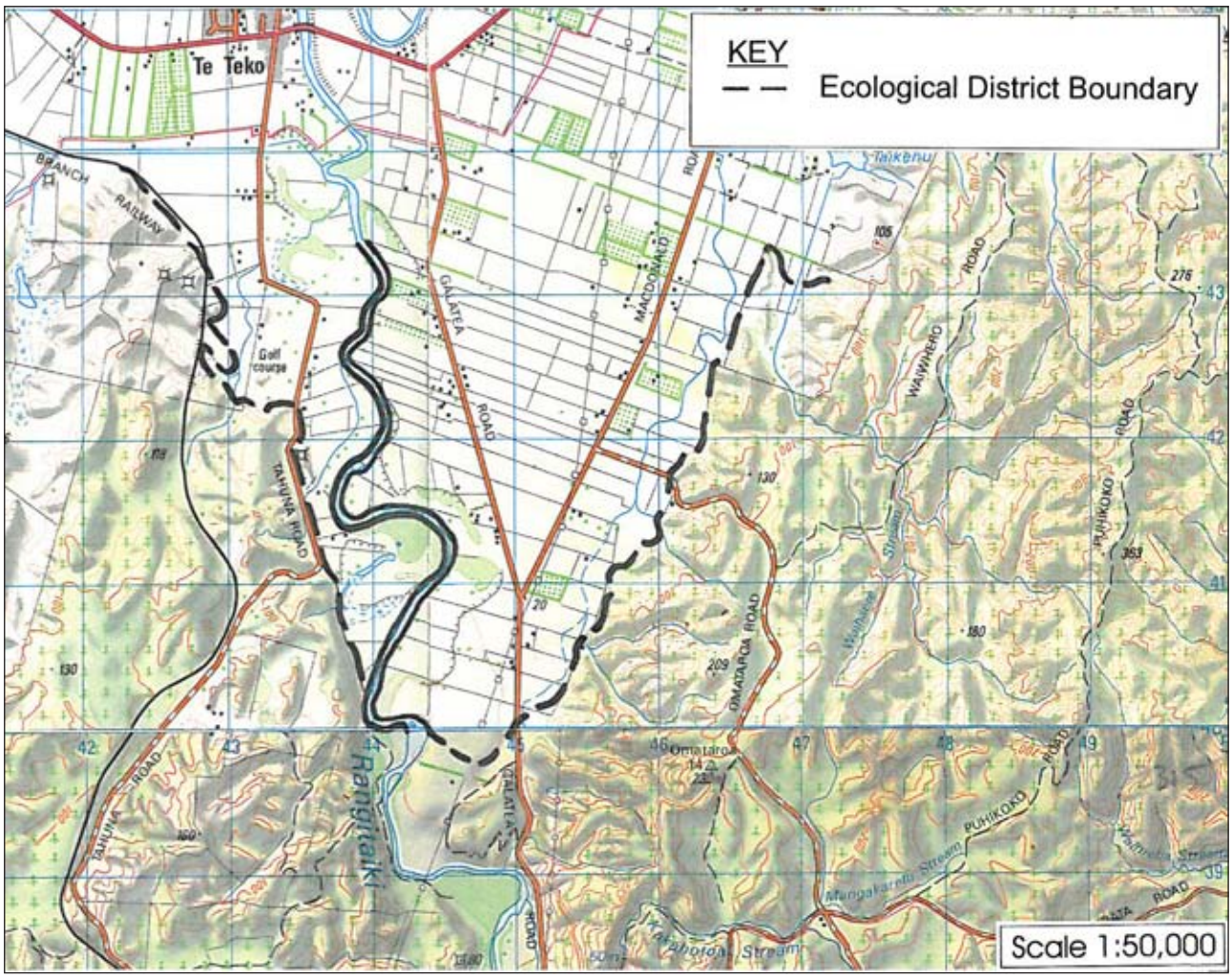
Vegetation A remnant area of kānuka forest which has established following clearance.

Flora & Fauna No significant plant species were recorded at this site.

Threat/Modification Although the forest is fenced, it is grazed throughout. Naturalised species dominate the understorey and ground cover. Periwinkle (*Vinca major*) forms dense mats on the forest floor. At the time of the field surveys in 1996 and 1998 this was the only known population of the species in the district. Grazing animals should be excluded and the periwinkle eradicated.

Justification Little of the ecological district remains in indigenous vegetation and although relatively small, this natural area is one of only four areas of kānuka forest remaining on the Rangitaiki Plains.

35: Rangitaiki River Marginal Strip



Rangitaiki River Marginal Strip (Part)[10]

Te Teko Natural Area No. 35
Area 16.02 ha
Grid Reference NZMS260 V15 439418
Landform Unit Alluvial plain
Status Protected—administered by Department of Conservation

BIOCLIMATIC ZONE	VEGETATION	LANDFORM
Semi-coastal	• Crack willow/pasture-blackberry treeland (with local mature scattered kānuka).	Flat
	• Brush wattle-mamaku-māhoe-crack willow scrub.	Flat
	• Brush wattle/gorse-pampas-buddleia shrubland.	Flat

Vegetation Map Not mapped.

Vegetation The vegetation of the site comprises predominantly exotic tree and shrubs, and pastures, with local indigenous species in the canopy and understorey.

Flora Taxa present include tōtara, *Carex secta, Diplazium australe, Muehlenbeckia australis* and māhoe.

Fauna No information available.

Threat/Modification No information available.

Discussion These areas are dominated by naturalised species, with the exception of some local kānuka about 4 m tall.

10 Part of this reserve is in Kaingaroa Ecological District.

36: Awaiti Conservation Area

Awaiti Conservation Area

Te Teko Natural Area No. 36
Grid Reference NZMS260 V15 450590
Area 1.77 ha
Landform Unit Wetland on Rangitaiki Plains
Status Administered by Department of Conservation

BIOCLIMATIC ZONE	VEGETATION	LANDFORM
Semi-coastal	• Naturalised grass-reed-sedgeland.	Wetland

Vegetation Limited indigenous vegetation persists in places. Open water is present in much of the area during winter months.

Flora No significant species recorded during this survey.

Fauna No survey has been undertaken but this site will provide habitat for a range of water birds and fish.

Threat/Modification Highly modified drainage system. There are probably ongoing issues with water management.

Discussion Part of a drain running parallel to Greig Road carrying water overflow from Awaiti Wildlife Management Reserve.

Although small and degraded this area contains small areas of indigenous wetland vegetation in an ecological district where very little remains of the original vegetation cover. The drains are located on Crown land and provide an opportunity for future ecological restoration.

37: Keir Kānuka

Keir Kānuka

Te Teko Natural Area No. 37
Grid Reference NZMS260 V15 416462
Area 2.40 ha
Landform Unit Alluvial plain (relict dune)
Status Protected

BIOCLIMATIC ZONE	VEGETATION	LANDFORM
Semi-coastal	1. Kānuka/gorse-prickly mingimingi (*Leptecophylla juniperina* var. *juniperina*) treeland.	Relict dune
Semi-coastal	2. (Ponderosa pine; *Pinus ponderosa*)/privet-barberry-hawthorn-kānuka shrubland	Relict dune
Semi-coastal	3. (Kānuka)/barberry-privet-blackberry-Japanese honeysuckle shrubland	Relict dune

Geology This site is on a relict dune on the Rangitaiki Plains. This is the only inland dune remaining on the plains and was identified as a nationally important geological landform by the New Zealand Geological Society. It is a moderately well defined landform of scientific and education value (Kenny and Hayward 1992).

Vegetation The vegetation of the site comprises a mixture of indigenous and naturalised species and planted pine trees.

Flora No significant taxa recorded.

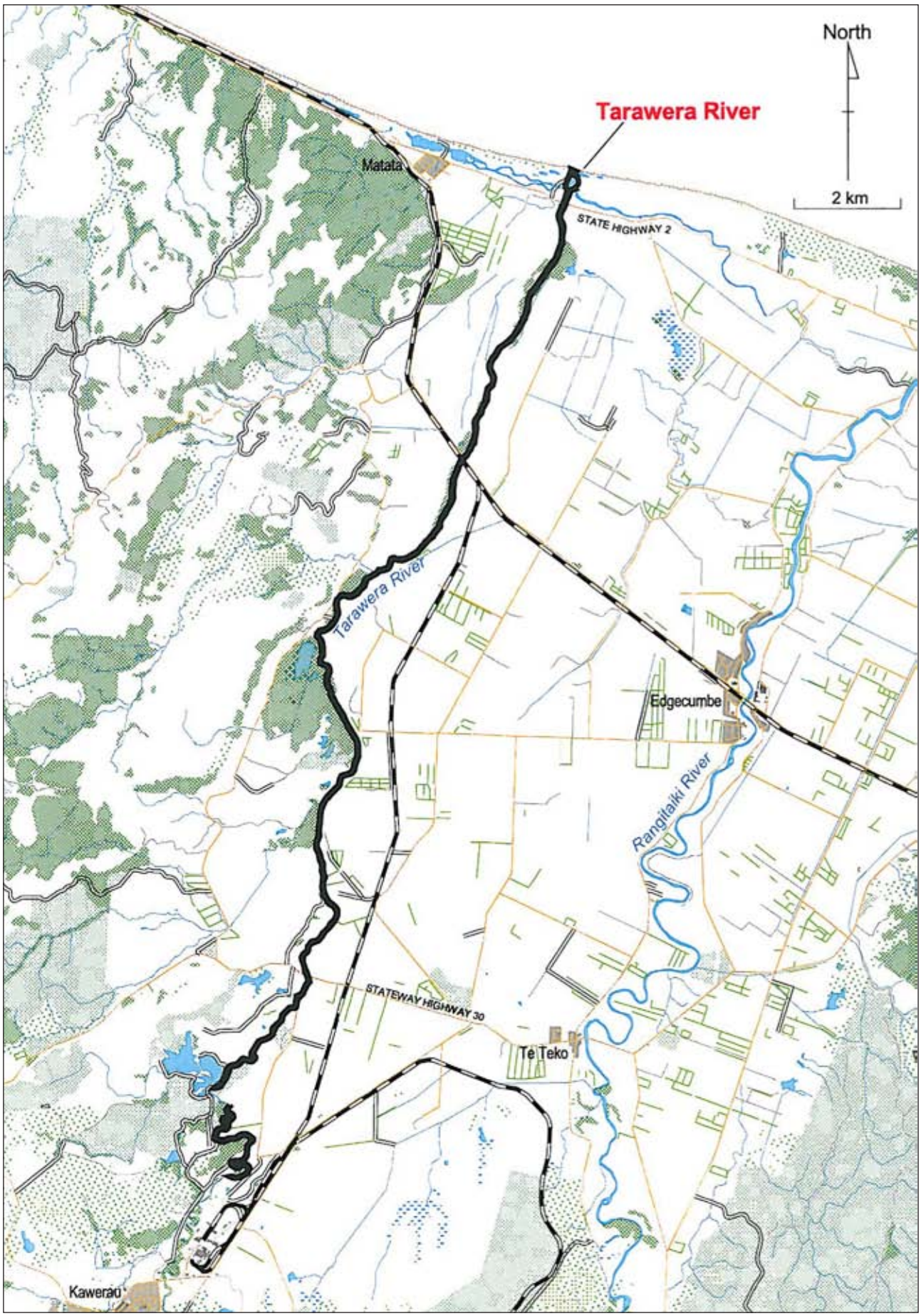
Fauna Blackbird (*Turdus merula*), house sparrow (*Passer domesticus*), and fantail recorded.

Threat/Modification The site is intermittently grazed and much of the area is dominated by naturalised weeds.

Justification Very little indigenous vegetation remains in the Te Teko Ecological District. This highlights the significance of any examples of indigenous vegetation in a degraded state remaining areas of indigenous vegetation. Although this site is degraded and naturalised species are common, it contains a distinctive indigenous element. This site is one of only four examples of kānuka forest remaining on the Rangitaiki Plains. It is the only example of indigenous vegetation on a nationally significant relict dune.

References Beadel 1998b

38: Tarawera River



Tarawera River

Te Teko Natural Area No.	38
Area	47.77 ha
Grid Reference	From NZMS260 V15 370423 to V15 433610
Landform Unit	River, estuarine channel
Recommended Area for Protection	Yes

Location:

This site includes all the Tarawera River channel. The Tarawera River rises from Lake Tarawera and flows into the Pacific Ocean, just east of Matata township.

General:

Prior to drainage of the Rangitaiki Plains, the lower Tarawera River meandered through the Rangitaiki flood plains to join with the Rangitaiki River at the Matata Lagoon, where both rivers flowed into the sea.

Drainage of the plains in the 1920s resulted in a new river mouth being cut out directly to sea immediately to the east of the Matata Lagoon. The river was subsequently straightened and stopbanked, and the surrounding land drained.

Effluent from pulp and paper mills built at Kawerau have impacted greatly on the river.

Mill effluent and geothermal discharges, coupled with a highly mobile pumice river bed, provide a restricted aquatic environment.

Freshwater Fish:

Fish commonly found in the river include shortfin eel, longfin eel ('Chronically Threatened-Gradual Decline' in Hitchmough *et al*. 2007), common bully, red-finned bully, giant bully, inanga, mosquito fish and goldfish. Species recorded but not commonly found include giant kōkopu ('Chronically Threatened-Gradual Decline' in Hitchmough *et al*. 2007), and rainbow trout. Several species which have not been recorded in the river itself but which use this section of the river as a migratory pathway to upstream tributaries include torrentfish, banded kōkopu, lamprey, and koaro.

The tributaries of the lower Tarawera River support relatively diverse freshwater fish communities in comparison with the river itself. The presence of longfin eel, shortfin eel, red-finned bully, torrentfish, common bully and inanga are fairly typical of most tributaries. The giant bully, banded kōkopu, lamprey, and rainbow trout are also present in several tributaries. Of particular importance is the Waikamihi stream for the presence of giant kōkopu, and the Mangaone stream for the presence of the only population of koaro recorded in the district.

Vegetation:	There is little or no submerged vegetation in the lower Tarawera River stopbanking has destroyed most natural vegetation and today the river margins are predominantly grazed pasture with extensive areas of willow and reed sweetgrass.
Justification :	One of the large habitats remaining in the ecological district. The Tarawera River comprises one of the three large river systems that formed the Rangitaiki Plains. The river provides habitat for a significant assemblage of indigenous fish species.

39: Rangitaiki River

Rangitaiki River

Te Teko Natural Area No.	39
Area	134.16 ha
Grid Reference	From NZMS260 V15 440400 to W15 514585
Landform Unit	River, estuarine channel
Recommended Area for Protection	Yes

Location: This site includes all of the Rangitaiki river channel.

General: This river is perhaps the most hydrologically modified of the three rivers in the district. The headwaters of the Rangitaiki river are situated in the Kaingaroa Ecological District, to which fish passage is severely restricted through the presence of two hydrodams situated upstream of the boundary of the district. The section of the river flowing through the ecological district is known as the lower Rangitaiki River. Like the Tarawera River the Rangitaiki now flows directly out to sea.

As it nears the coast, the Rangitaiki river used to flow west along the sand dunes before joining the Tarawera and Awaiti Rivers and flowing out to sea near Matata. Following the construction of the Rangitaiki cut the river subsequently flowed directly out to sea at Thornton.

As a result of modification the only associated major tributary of the lower Rangitaiki river is Reids Central Canal, which meets the river close to the coastal outlet at Thornton.

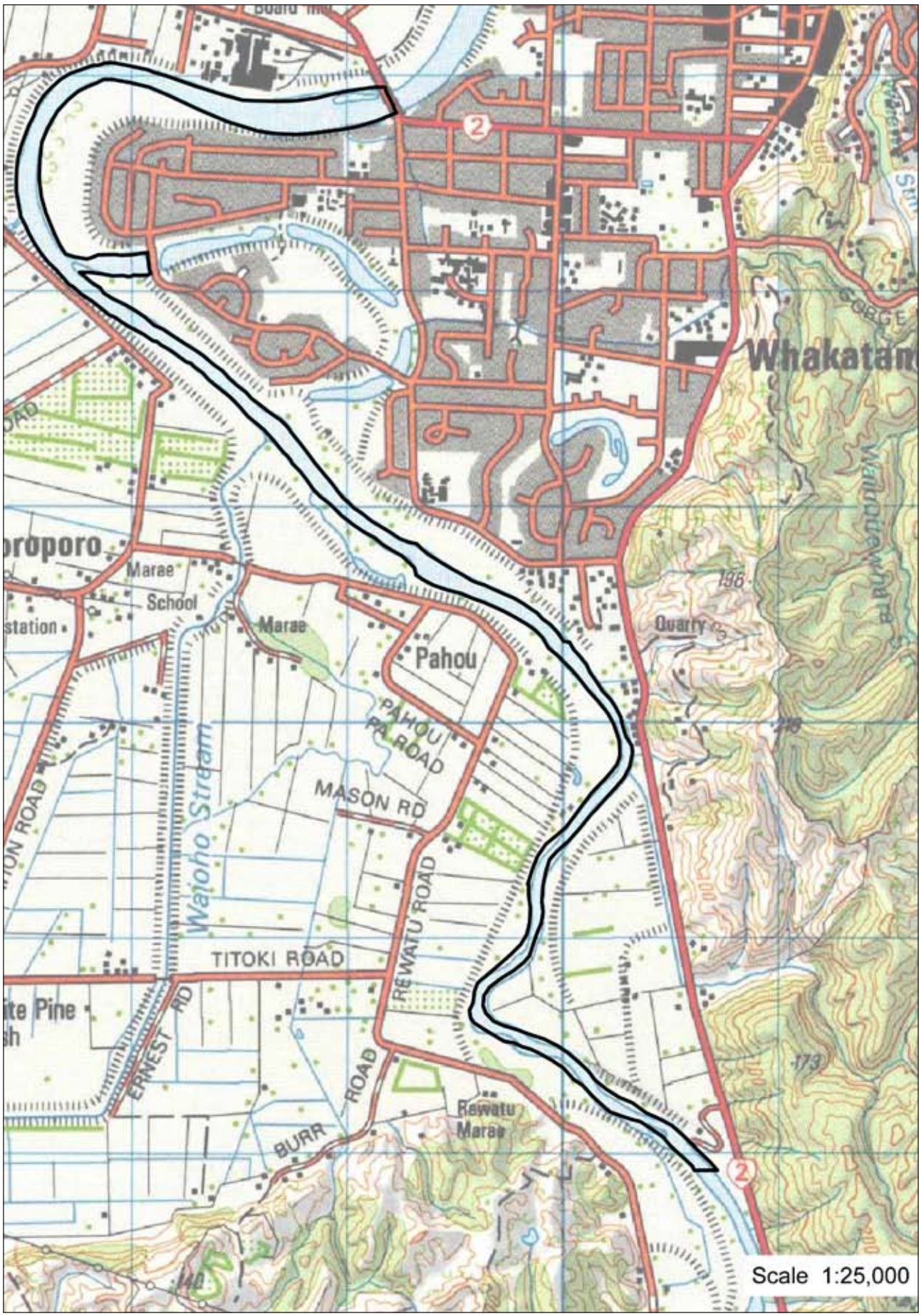
Freshwater Fish: Indigenous fish recorded in the river include inanga, longfin eel ('Chronically Threatened-Gradual Decline' in Hitchmough *et al.* 2007), shortfin eel, common bully, common smelt, banded kōkopu , giant kōkopu ('Chronically Threatened-Gradual Decline' in Hitchmough *et al.* 2007), and torrentfish. Koaro whitebait have also been recorded in the river by Saxton *et al.* (1987). Exotic species recorded include both brown trout and rainbow trout.

There is one recorded whitebait spawning site below the SH2 bridge (Mitchell 1990). The mouth of the lower Rangitaiki River is a popular location for whitebaiting and the river itself provides local trout fishing.

Justification: One of the largest habitats remaining in the ecological district. The Rangitaiki River comprises one of the three large river systems that formed the Rangitaiki Plains. The river provides habitat for a significant assemblage of indigenous fish species.

Along with the Whakatane and Tarawera rivers, the Rangitaiki river is important in terms of cultural, recreation, biological and landscape values.

40: Whakatane River



Whakatane River

Te Teko Natural Area No.	40
Area	72.90 ha
Grid Reference	From NZMS260 W15 607480 to W15 626544
Landform Unit	River, estuarine channel
Recommended Area for Protection	Yes

Location: This site includes all of the Whakatane River channel.

General: The Whakatane River rises in the Urewera Ranges. It could be considered the least modified of the three rivers in the ecological district. It has retained its original outlet to the coast and channelisation in the lower section of the Whakatane river has been less intensive than for the Tarawera and the Rangitaiki.

Freshwater Fish: To date there has been very little survey work carried out on the fish of the lower Whakatane River, however it is expected that the river would support communities similar to the lower Rangitaiki River and lower Tarawera River including, longfin eel ('Chronically Threatened-Gradual Decline' in Hitchmough *et al.* 2007), shortfin eel, inanga, common smelt, and common bully, and would also provide an important upstream migratory pathway for galaxiids and other migrants.

Brown trout are present in the lower Whakatane River, and there is recreational fishing by locals in this section of the river.

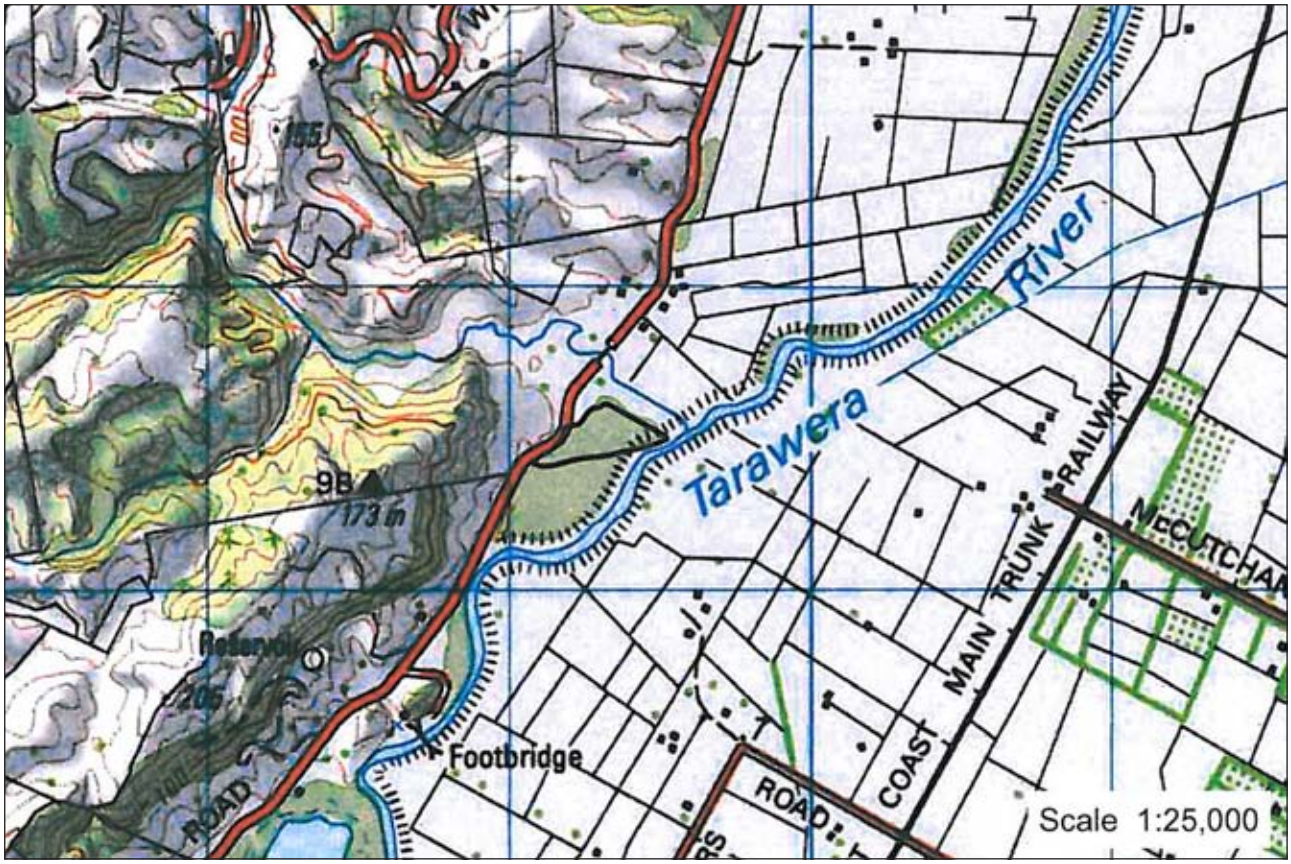
Only one known inanga spawning ground exists at present, located on the island just upstream of the SH2 road bridge (Rob Donald, pers. comm.).

Vegetation: Stopbanking, river training works and reclamation has destroyed the original vegetation along the margins of the Whakatane River where it passes through the Te Teko Ecological District. Naturalised weed species and area of poplars and willows, planted to control erosion, are now the predominant vegetation types above the zone of saltwater influence. Vegetation of the estuary is mapped, described, and assessed in RAP 4—Whakatane Estuary.

Justification: The Whakatane River is one of the largest habitats remaining in the ecological district. It comprises one of three large river systems that formed the Rangitaiki Plains. The river provides uninterrupted linkages to a huge diversity of habitats upstream. It also provides habitat for a significant assemblage of indigenous fish species.

The Whakatane River, along with the Tarawera River and Rangitaiki River is important in terms of a diverse range of values, including cultural, recreational, landscape and biological.

41: Braemar Road A



Braemar Road A

Te Teko Natural Area No.	41
Area	4.28 ha
Grid Reference	NZMS260 V15 393535
Landform Unit	Wetland
Status	Unprotected
Recommended Area for Protection	Yes

BIOCLIMATIC ZONE	VEGETATION	LANDFORM
Semi-coastal	• Grey willow-privet shrubland.	Wetland

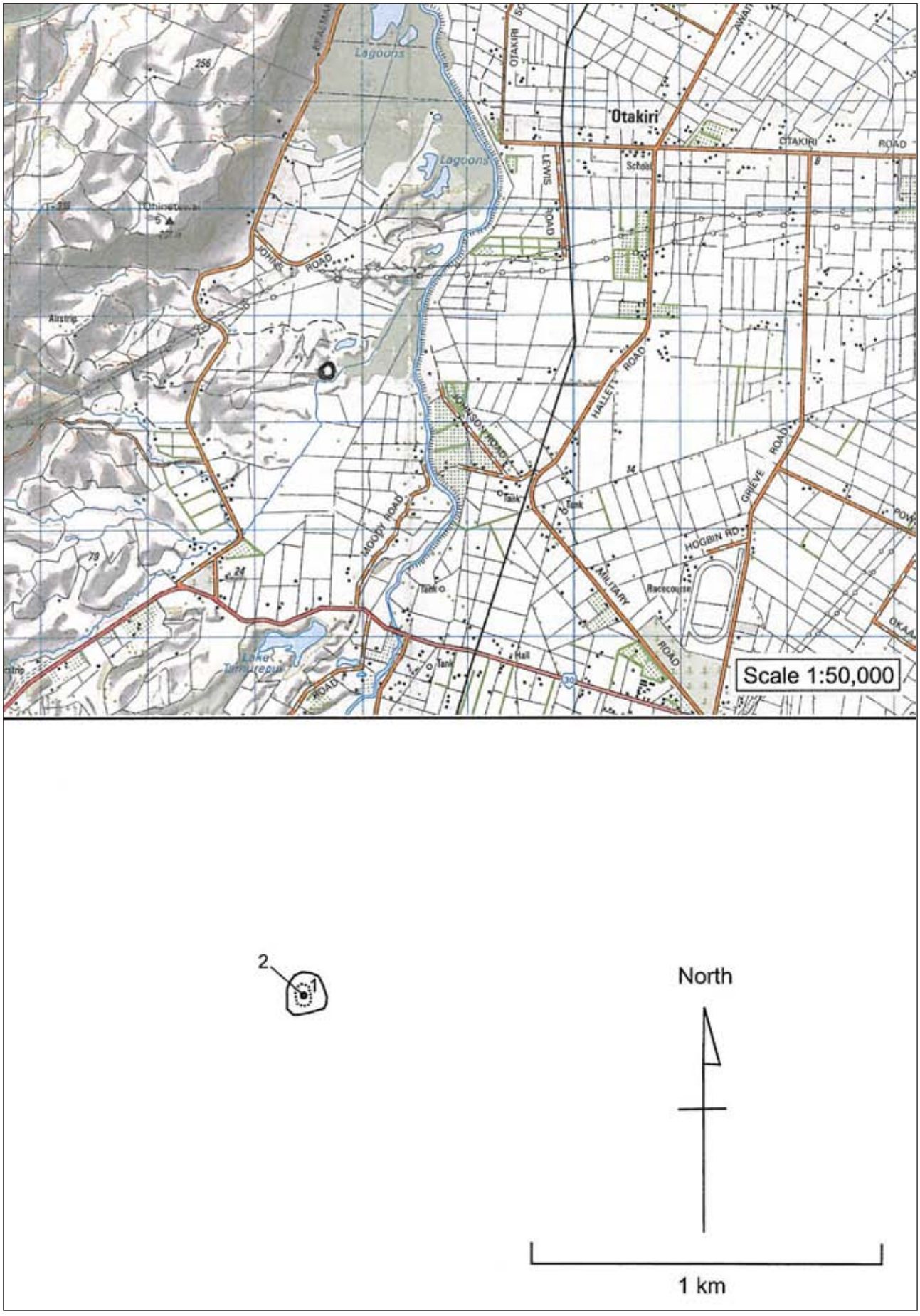
Vegetation & Flora Grey willow and privet form a shrubland with local *Coprosma tenuicaulis*, *Coprosma propinqua*, and *Baumea tenax*. Blackberry is locally dominant.

Fauna No significant species recorded.

Threat/Modification The site has been cleared, and is at least partially grazed.

Discussion The extent of wetland vegetation in the Te Teko Ecological District has been dramatically reduced since 1840, and although this site is highly modified, it comprises one of the few remaining examples of wetland habitat on the plains.

42: Onepu Pond



Onepu Pond

Te Teko Natural Area No. 42
Grid Reference NZMS260 V15 377485
Area 1.04 ha
Landform Unit Wetland
Status Protected by Sec. 221 RMA covenant

BIOCLIMATIC ZONE	VEGETATION	LANDFORM
Semi-coastal	1. (Grey willow forest)/indigenous species reed-sedgeland.	Wetland
	2. Open water.	Pond

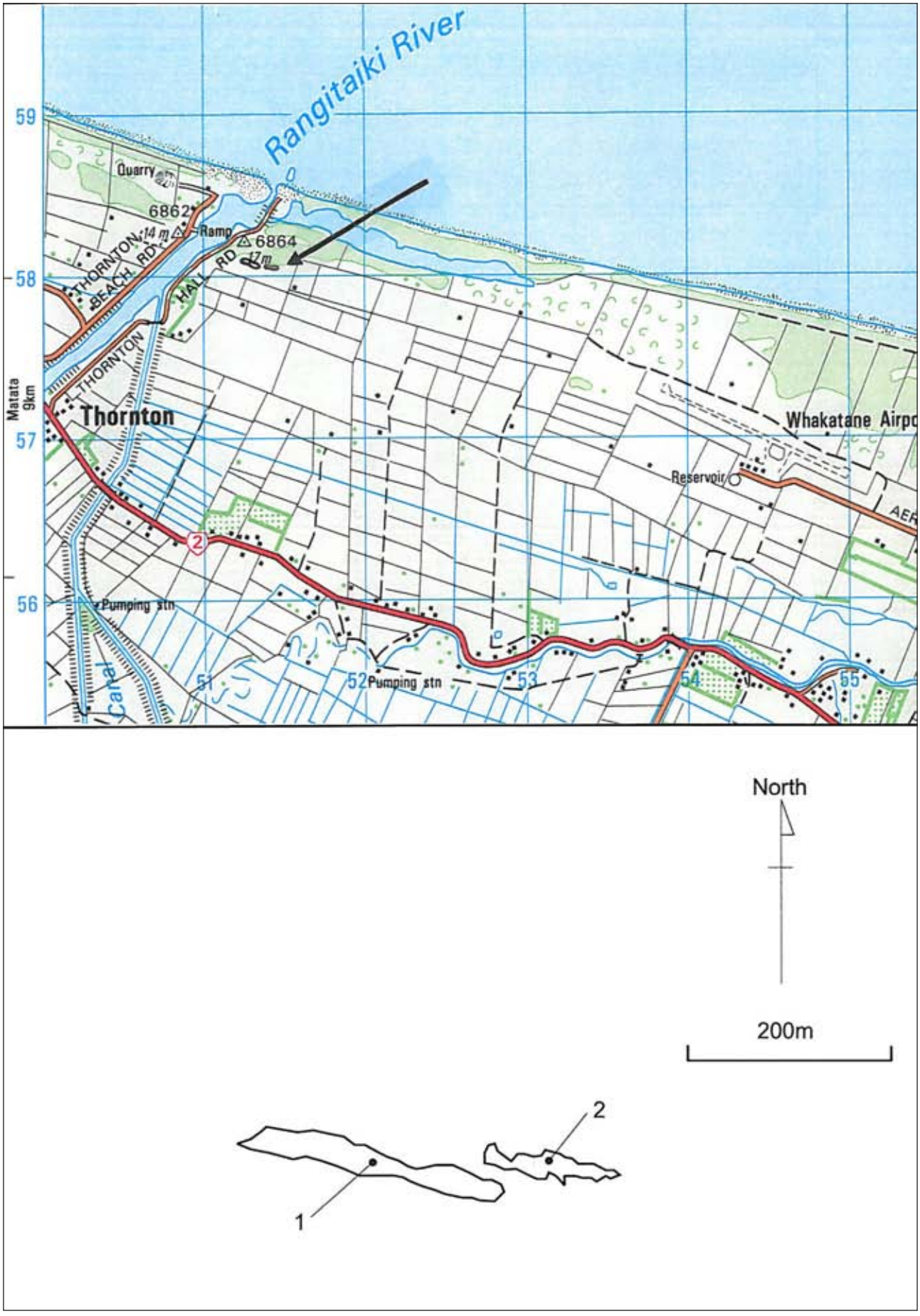
Vegetation A pond has been excavated by the landowner and its margin has been colonised by indigenous reeds and sedges. Grey willows have also established on the pond margin.

Flora No significant indigenous species were noted during the survey.

Fauna A range of common terrestrial and water birds utilise the site (J. Bevan pers. comm.).

Discussion This partially restored wetland area has been colonised by indigenous wetland plants and provides valuable wildlife habitat.

43: Steel Kānuka and Wetland



Steel Kānuka and Wetland

Te Teko Natural Area No. 43
Grid Reference NZMS260 W15 513583
Area 0.24 ha
Landform Unit Sand dunes
Status Section 221 RMA covenant

BIOCLIMATIC ZONE	VEGETATION		LANDFORM
Coastal	1.	Soft rush-Mercer grass-*Juncus acuminatus* rush-grassland.	Dune swale
	2.	Kānuka treeland.	Coastal dunes

Vegetation

Coastal kānuka occurs in scattered pockets over pōhuehue and naturalised grasses and flat weeds. The wetland is dominated by naturalised wetland species, including soft rush, *Juncus acuminatus*, and Mercer grass, with creeping buttercup common throughout.

Flora

Thornton kānuka is present in this covenant. This species is classed as 'Taxonomically Indeterminate-Threatened-Nationally Vulnerable' in de Lange *et al*. 2009.

Fauna

Up to 30 pied stilt (classed as 'At Risk-Declining' in Miskelly *et al*. 2008) use the wetland and it is likely to be a significant contributor to the local pied stilt population on the Rangitaiki Plains (R. Pierce pers. comm.).

Discussion

Although the areas of Thornton kānuka treeland are small and scattered, they are part of a larger area of Thornton kānuka-dominant vegetation along the Thornton dunelands (See TTNA 7). Thornton kānuka is a nationally threatened species.

The wetland is similarly small and degraded, but nevertheless provides valuable habitat for pied stilt, an 'At Risk' species sensitive to the loss of shallow open wetlands.

References

Gosling 2001b.

44: Walker Road Wetlands

Walker Road Wetlands

Te Teko Natural Area No. 44
Grid Reference NZMS260 V15 473594; V15 475597
Area 2.49 ha
Landform Unit Sand dunes
Status Unprotected

BIOCLIMATIC ZONE	VEGETATION	LANDFORM
Coastal	• Juncus edgariae/pasture rushland.	Wetland
Coastal	• Giant spike sedge-reed sweetgrass-Juncus articulatus sedgeland.	Wetland
Coastal	• Giant spike sedge-reed sweetgrass/spearwort sedgeland.	Wetland
Coastal	• (Grey willow)/reed sweetgrass grassland.	Wetland
Coastal	• Reed sweetgrass-mercer grass/spearwort grassland.	Wetland
Coastal	• Juncus edgariae-spearwort-Juncus articulatus-open water rushland.	Wetland

Vegetation Small wetlands dominated by a mixture of sedges, rushes, reed sweetgrass, and exotic herbs, with areas of open water.

Flora No significant species recorded.

Fauna No threatened fauna species have been recorded at the site, but it is likely to provide habitat for pied stilt ('At Risk-Declining' in Miskelly *et al*. 2008) and may provide habitat for white-faced heron and short-term seasonal use by white heron (classed as 'Threatened-Nationally Critical' in Miskelly *et al*. 2008), which have both been recorded nearby. It is also likely to provide habitat for other water birds such as mallard and paradise shelduck.

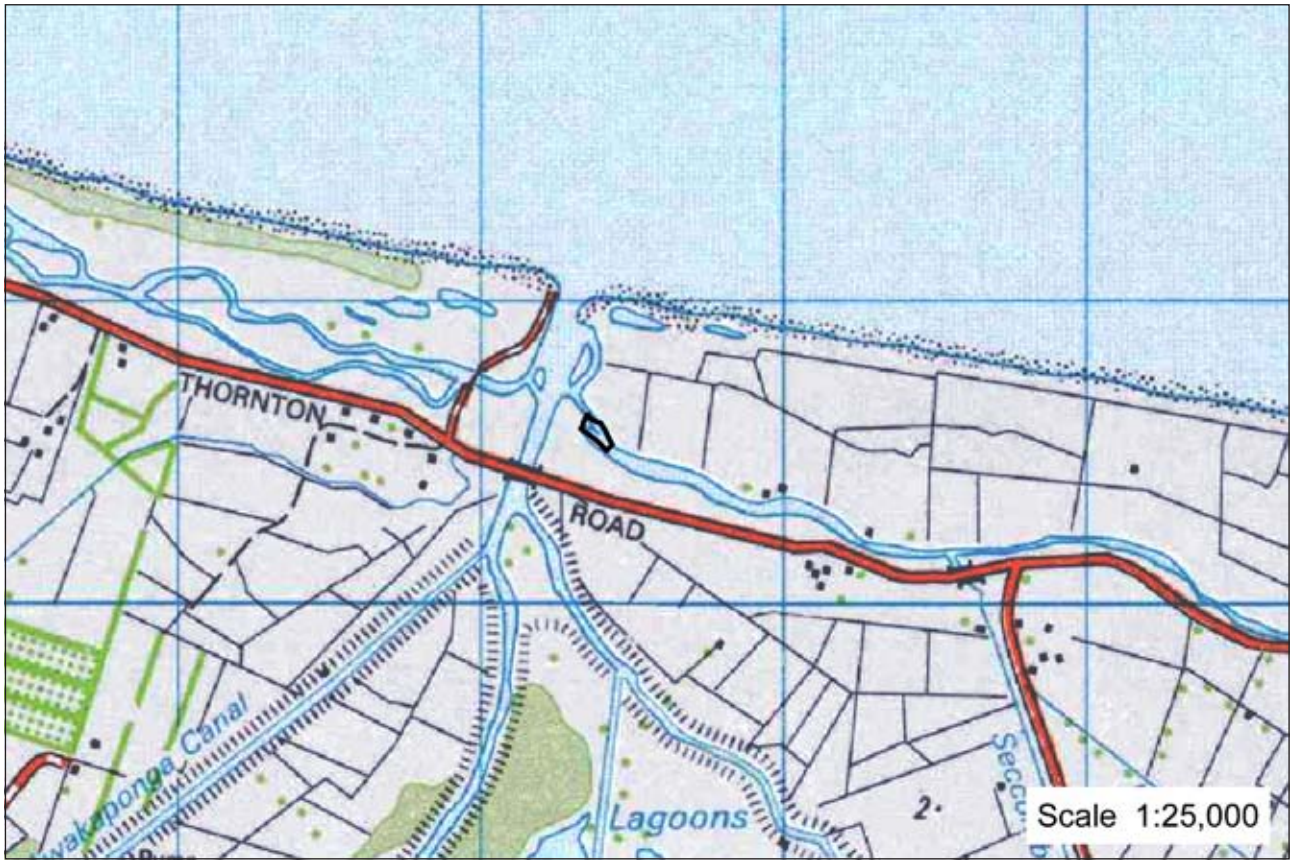
Threat/Modification The site is currently grazed, which causes pugging of the soil, damage to vegetation, and disturbance of fauna. Reed sweetgrass is present through most of the wetland and may spread to replace indigenous species.

Discussion Although small and dominated by exotic species, these two wetlands are two of the few remaining wetlands in Te Teko Ecological District. Wetlands are a national priority for protection on private land (MfE and DOC 2007).

Notes There are several smaller wetlands nearby which are dominated by exotic species and not included in this site.

References Beadel *et al*. 1996b; OSNZ 2006; Gosling & Beadel 2000a.

45: Tarawera River Raupō Wetland



Tarawera River Raupō Wetland

Te Teko Natural Area No.	45
Grid Reference	NZMS260 V15 434605
Area	0.51 ha
Landform Unit	Wetland
Status	Unprotected
Recommended Area for Protection	Yes

BIOCLIMATIC ZONE	VEGETATION	LANDFORM
Coastal	• Raupō wetland.	Wetland

Vegetation Small wetland which has been isolated by development and modified when the drainage patterns changed following the artificial diversion of the Rangitaiki River to the Thornton Outlet. It would once have been part of an extensive wetland.

Flora No threatened species recorded. Species present include *Schoenoplectus tabernaemontani, Carex virgata, Carex secta, Eleocharis acuta,* arrow grass, and bachelor's button.

Fauna Pukeko and ducks have been recorded from the area.

Condition/Pressures A small wetland that was once part of a former extensive wetland, now isolated by development, and modified following artifical diversion of the Rangitaiki River to the Thornton outlet.

Discussion Although this site is small, wetland vegetation has been greatly reduced in extent in the Te Teko Ecological District, and this is one of the few remaining wetlands in Te Teko Ecological District. Wetlands are a national priority for protection.

References Beadel *et al*. 1996b; OSNZ 2006; Gosling & Beadel 2000.

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References and selected bibliography

Aldridge R. 1985: Climate. *In* W.A. Pullar, *Soils and Land Use of Rangitaiki Plains, North Island, New Zealand.* Pp 9–10. New Zealand Soil Survey Report 86.

Allan H.H. 1961: *Flora of New Zealand Vol. 1.* Government Printer, Wellington, New Zealand. 1085 pp.

Anon 1985: Bay of Plenty wildlife habitat inventory. *Unpublished Report.* Wildlife Service. Department of Internal Affairs, Rotorua.

APR Consultants 1993: Matata Lagoon Improvement Project. Prepared for the Department of Conservation. 135 pp.

Atkinson I.A.E. 1985: Derivation of vegetation mapping units for an ecological survey of Tongariro National Park, North Island, New Zealand. *New Zealand Journal of Botany 23*(3): 361–378.

Atkinson I.A.E.; Millener P.R. 1991: An ornithological glimpse into New Zealand's pre-human past. 729–194. In "Acta XX Congressus Internationalis Ornithologici Volume 1". Published by New Zealand Ornithological Congress Trust Board.

Bayfield M.A.; Benson M.A. 1985: Egmont ecological region. New Zealand Protected Natural Areas Programme. Department of Lands and Survey, Wellington.

Beadel S.M. 1985: The vegetation of the coastal reserves between Golf Links Road (Rangitaiki Plains) and Otaramakau, Whakatane District. Report prepared for D.J. Shaw Associates, Resource Management, Research, Planning Consultants, Rotorua. 25 pp.

Beadel S.M. 1987: An account of some sand dune communities of the Eastern Bay of Plenty. *Rotorua Botanical Society Newsletter 11*: 29-39.

Beadel S.M. 1988: A register of threatened and local plant taxa in the Eastern Region, Department of Conservation: Their distribution and status. *Technical Report Series No. 6.* Report prepared for the Department of Conservation, Rotorua. 72 pp plus map.

Beadel S.M. 1988: Botanical conservation values of the conservation estate – Whakatane Management Planning Area. Report prepared for the Department of Conservation, Rotorua. 72 pp.

Beadel S.M. 1990: Problem plant strategy: Bay of Plenty Conservancy. Department of Conservation, Rotorua. *Wildland Consultants Ltd Contract Report.* 21 pp plus appendices.

Beadel S.M. 1992a: Vegetation and flora of Tumurau (Braemar Lagoon). Technical Report Series No. 16. Bay of Plenty Conservancy, Department of Conservation. 37 pp.

Beadel S.M. 1992b: Vegetation and flora of Lake Pupuwharau and environs. Department of Conservation, Whakatane. 13 pp.

Beadel S.M. 1992c: Vegetation and flora of Lake Pupuwharau and environs, Kawerau. *Rotorua Botanical Society Newsletter 26 :* 24-34.

Beadel S.M. 1992d: Botanical conservation rankings and management priorities – Te Teko Ecological District. In "Irving R.M. and Beadel, S.M.; Botanical surveys and assessments of wildlife reserves in the Te Teko Ecological District". *Technical Report Series No. 10.* Bay of Plenty Conservancy, Department of Conservation, Rotorua. 198 pp.

Beadel S.M. 1992e: The vegetation and botanical conservation values of the Tahuna-Putauki Block, Kawerau. Department of Conservation, Whakatane. 15 pp.

Beadel S.M. 1992f: Thornton Lagoon Wildlife Management Reserve. In "Irving R.M. and Beadel, S.M.; Botanical surveys and assessments of wildlife reserves in the Te Teko Ecological District". *Technical Report Series No. 10.* Bay of Plenty Conservancy, Department of Conservation, Rotorua. 198 pp.

Beadel S.M. 1992g: Lake Tamurenui Wildlife Management Reserve. In "Irving R.M. and Beadel, S.M.; Botanical surveys and assessments of wildlife reserves in the Te Teko Ecological District". *Technical Report Series No. 10.* Bay of Plenty Conservancy, Department of Conservation, Rotorua. 198 pp.

Beadel S.M. 1992h: Orini Wildlife Management Reserve. In "Irving R.M. and Beadel, S.M.; Botanical surveys and assessments of wildlife reserves in the Te Teko Ecological District". *Technical Report Series No. 10.* Bay of Plenty Conservancy, Department of Conservation, Rotorua. 198 pp.

Beadel S.M. 1992i: Vascular plant species lists of several sand dunes, estuaries and headlands in the Bay of Plenty. 12 pp.

Beadel S.M. 1992j: Threatened and local plant monitoring – Whakatane Field Centre, Department of Conservation. 10 pp plus appendices.

Beadel S.M. 1992k: Threatened and local plant survey (1989–1992) – Whakatane Field Centre, Department of Conservation. 10 pp.

Beadel S.M. 1992l: Threatened and local plants of Bay of Plenty Conservancy. *Technical Report Series No. 13*. Department of Conservation, Rotorua. 77 pp plus maps.

Beadel S.M. 1993a: Botanical conservation values of lands administered by the Department of Conservation, Bay of Plenty Conservancy. Part One: Inventory of existing botanical information. Department of Conservation, Rotorua. 382 pp.

Beadel S.M. 1993b: Problem plant management strategy, Whakatane District Council. Whakatane District Council. 81 pp.

Beadel S.M. 1993c: Vegetation and flora of Kohika Wetland, Rangitaiki Plains. Department of Conservation, Whakatane. 8 pp.

Beadel S.M. 1994a: Significant indigenous vegetation of the Bay of Plenty coastal zone. Bay of Plenty Regional Council. 412 pp.

Beadel S.M. 1994b: Vegetation and flora of Young property wetland, Rangitaiki Plains. Wildland Consultants Ltd, Whakatane. 14 pp.

Beadel S.M. 1995a: Vegetation and flora of lands administered by Bay of Plenty Conservancy. Department of Conservation. Rotorua. *Wildland Consultants Ltd Contract Report No. 130*. 556 pp.

Beadel S.M. 1995b: Vegetation and flora of Kopuatawhiti wetland, Rangitaiki Plains. Department of Conservation, Whakatane. 7 pp.

Beadel S.M. 1995c: Management options for pampas (*Cortaderia jubata* and *C. selloana*) in the Bay of Plenty region. Environment Bay of Plenty. 34 pp.

Beadel S.M. 1995d: Potential environmental weeds of the Bay of Plenty region. Environment Bay of Plenty, Whakatane. 133 pp.

Beadel S.M. 1995e: Vegetation and fauna habitats of Bay of Plenty Region (preliminary scoping study). Environment BOP, Whakatane. *Wildland Consultants Ltd Contract Report No. 131*. 33 pp.

Beadel S.M. 1996a: Vegetation and avifauna of a proposed motorcamp site. Bunyan Road, Whakatane. Interim draft report. *Wildland Consultants Ltd Contract Report No. 139*. 15 pp.

Beadel S.M. 1996b: Vegetation and flora of the proposed Hassall property subdivision, Moore Road, Thornton. *Wildland Consultants Ltd Contract Report No. 148*.

Beadel S.M. 1998a: Digitisation of selected coastal ecological sites, Bay of Plenty region. *Wildland Consultants Ltd Contract Report No. 208*. 3 pp.

Beadel S.M. 1998b: Indigenous vegetation of the Keir property, Rangitaiki Plains. *Wildland Consultants Ltd Contract Report No. 216*. 10 pp.

Beadel S.M. 1999a: Vegetation and flora of Keepa Road Conservation Area. Wildland *Consultants Ltd Contract Report No. 240*.

Beadel S.M. 1999b: Vegetation and flora of Whangakopikopiko Wildlife Management Reserve. *Wildland Consultants Ltd Contract Report No. 239*. 19 pp.

Beadel S.M. 2009: Regionally uncommon plant species in the Bay of Plenty. *Wildland Consultants Contract Report No. 1175a*.

Beadel S.M.; Mackinnon S.M.; and Shaw W.B. 1996a: Geothermal vegetation of the Bay of Plenty Region. *Wildland Consultants Ltd Contract Report No. 155*. 234 pp.

Beadel S.M.; Shaw W.B. 1996: Indigenous ecosystems and natural heritage of the Kawerau district. *Wildland Consultants Ltd Contract Report No. 153*. 72 pp.

Beadel S.M.; Shaw W.B. 1998: Vegetation change and management of the Tumurau Wetland. *Wildland Consultants Ltd Contract Report No. 209*. 28 pp.

Beadel S.M.; Shaw W.B. 1999: Rehabilitation planting of drainage channel margins on the Rangitaiki Plains.*Wildland Consultants Ltd Contract Report No. 285*. 17 pp.

Beadel S.M.; Shaw W.B. 2000: Ecological effects of recent earthworks on the Kohika wetland. *Wildland Consultants Ltd Contract Report No. 316.* 29 pp.

Beadel S.M., Shaw W.B., and Gosling D.S. 1999: Taneatua Ecological District. Survey report for the Protected Natural Areas Programme. Department of Conservation, Rotorua. 267 pp.

Beadel S.M., Townsend A.J. and Shaw W.B. 1996b: Natural heritage of the Whakatane District. *Wildland Consultants Ltd Contract Report No. 140.* 280 pp plus maps.

Beadel S.M., Townsend A.J. and Shaw W.B. 1996d: Evaluation of natural heritage sites in Whakatane District. *Wildland Consultants Ltd Contract Report No. 157.* 15 pp.

Brown E.A. 1981: Flora and vegetation of the Kawerau Region, North Island, New Zealand. *Unpublished Report.* 10 pp.

Brownsey P.J.; Given D.R.; Lovis J.D. 1985: A revised classification of New Zealand pteridophytes with a synonymic checklist of species. *New Zealand Journal of Botany 23*: 361–378.

Bull P.C. ; Gaze P.D.; Robertson C. J.R. 1985: The atlas of bird distribution in New Zealand. A joint project by Ecology Division DSIR, New Zealand Wildlife Service and The Ornithological Society of New Zealand Inc. New Zealand Government Printer, Wellington. 296 pp.

Campbell E.O.; Heine J.C. ; Pullar W.A. 1973: Identification of plant fragments and pollen from peta deposits in Rangitaiki Plains and Maketu Basin. *New Zealand Journal of Botany 11*: 317–330.

Cheeseman T.F. 1925: Manual of the New Zealand Flora. Government Printer, Wellington. 1163 pp.

Christian C. S. 1957: The concepts of land units and land systems. *Proceedings IX Pacific Congress 20*: 74–81.

Coates C. R. 1955–56. A brief history of Kopeopeo. *Whakatane and District Historical Society Journal 4.*

Connor H.E.; Edgar E. 1987: Name changes in the indigenous New Zealand Flora, 1960–1986 and Nomina Nova IV, 1983–1986*. *New Zealand Journal of Botany 25*: 115–170.

Cowie J.D.; Milne J.D.G. 1973: Maps and sections showing the distribution and stratigraphy of North Island loess and associated deposits, New Zealand. *New Zealand Soil Bureau Map 129, to accompany New Zealand Soil Survey Report 29.*

Crozier M.J.; Gage M.; Pettinga J.R.; Selby M.J.; Wasson R.J. 1985: The stability of hillslopes. pp 45–66 *In* Soons J.M. and Selby M.J. (eds). Landforms of New Zealand. Longman Paul Limited. 392 pp.

Daugherty C. H.; Towns D.R.; Atkinson I.A.E.; Gibbs G.W. 1990. The significance of the biological resources of New Zealand islands for ecological restoration. Pp. 9–21 *In* Towns, D.R., Daugherty, C. H., Atkinson, I.A.E. (Eds). Ecological Restoration of New Zealand Islands. Conservation Sciences Publication No. 2.

de Lange P.J., Norton D.A., Courtney S.P., Heenan P.B., Barkla J.W., Cameron E.K., Hitchmough A.J. 2009: Threatened and uncommon plants of New Zealand (2008 revision). *New Zealand Journal of Botany 47*: 61–96.

de Lisle J.F.; Kerr I.S. 1962: The climate and weather of the Bay of Plenty region. *N.Z. Meteorological Service Miscellaneous Publication* 115(1). Reprinted from Ministry of Works, 1962. National Resources Survey Part II. Bay of Plenty region, pp 45–46. Compiled by Town and Country Planning Branch, Ministry of Works.

Department of Conservation 1989 (Draft): Matata Lagoon Wildlife Refuge Management Plan. *Technical Report 10*. Rotorua Regional Office. 44 pp.

Department of Conservation 1993a: Amphibian and reptile distribution scheme. Head Office, Wellington.

Department of Conservation 1993b: Bay of Plenty Conservancy bat recording scheme, Rotorua.

Department of Conservation 1993c: Bay of Plenty Conservancy unpublished Blue Duck records. Rotorua.

Department of Conservation 1993d: Data Base: North Island kaka. Wellington.

Department of Conservation 1993e: Falcon database. Head Office, Wellington.

Department of Conservation 1993f: Kiwi call scheme. Head Office, Wellington.

Department of Conservation 1993g: NZMS260 1:50,000 Maps: Distribution of sites of special wildlife interest and high priority fauna taxa. Bay of Plenty Conservancy, Rotorua.

Department of Conservation 1997: Conservation Management Strategy for Bay of Plenty Conservancy 1997–2007. Volume II. 55 pp plus maps.

Department of Scientific and Industrial Research 1954: General Survey of the Soils of the North Island, New Zealand. Soil Bureau Bulletin (n.s.)5. 285 pps plus maps.

Department of Scientific and Industrial Research 1964: Soils of New Zealand. Map to accompany Soil Bureau Bulletin No 26 plus maps.

Diamond J.M. 1975: The island dilemma: lessons of modern biogeographical studies for the design of natural reserves. *Biological Conservation 7*(2): 129–145.

Dowding J.E. 2001: Natal and breeding dispersal of northern New Zealand dotterels. *Conservation Advisory Science Notes No. 338*. Department of Conservation, Wellington.

Druce A.P. 1980: Trees, shrubs, and lianes of New Zealand (including wild hybrids). Botany Division, Department of Scientific and Industrial Research, Lower Hutt. 88 pp.

Eades P.A. and Shaw W.B. 2000a: Survey and monitoring in the Rangitaiki area, Bay of Plenty conservancy. Volume I—Summary and analysis. *Wildland Consultants Ltd Contract Report No. 356*. 77 pp.

Eades P.A. and Shaw W.B. 2000b: Survey and monitoring in the Rangitaiki area, Bay of Plenty conservancy. Volume II—Inventory. *Wildland Consultants Ltd Contract Report No. 356*. 293 pp.

Environment BOP 2002 (Draft): Rangitaiki/Tarawera Flood plains Wetlands–Hydrological Regime.

Fieldes M. and Furkert R.J. 1978: Source of alluvium in parent materials of Opouriao and Paroa soils. *In* W.A. Pullar, S.R. Hewitt and J.C. Heine, *Soils and Land Use of Whakatane Borough and Environs, Bay of Plenty, New Zealand,* Appendix 8. New Zealand Soil Bureau Bulletin 38.

Fergusson P. 1996: The restoration of Lake Tamurenui. *Royal Society Teaching Fellowship*. Prepared for the Department of Conservation. 87 pp.

Gibbons W.H. 1990: The Rangitaiki 1890–1990. Settlement and drainage on the Rangitaiki. Whakatane and District Historical Society, Whakatane, New Zealand. 229 pp.

Gibbs H.S.; Cowie J.D. and Pullar W.A. 1968: pp 47–67 *In* Soils of New Zealand Part 1. *New Zealand Soil Bureau Bulletin 26(1)*. DSIR. Government Printer.

Gill B (Convenor) 2010: Checklist of the birds of New Zealand, Norfolk, and Macquaries Islands, and the Ross Dependency, Antarctica. Fourth edition 2010. Te Papa Press, Wellington.

Given D.R. 1981: Rare and endangered plants of New Zealand. A.H. & A.W. Reed Ltd, Wellington. 154 pp.

Gosling D.S. 1999: Indigenous vegetation of the Rau property, Butlers Road, Whakatane. *Wildland Consultants Ltd Contract Report No. 247*. 8 pp.

Gosling D.S. 2001a: Indigenous vegetation and flora of the proposed Gordon property subdivision, Thornton Road, Rangitaiki Plains. *Wildland Consultants Ltd Contract Report No. 455*. Prepared for R.M., J.R. and C. J. Gordon. 17 pp.

Gosling D.S. 2001b: Restoration plan for A.D. and D.W. Steel, Thornton Hall Road, Thornton. *Wildland Consultants Ltd Contract Report No. 451*. 19 pp.

Gosling D.S. 2001c: Whakatane District Council vegetation covenant monitoring 2001. *Wildland Consultants Ltd Contract Report No. 376*. Prepared for Whakatane District Council. 267 pp.

Gosling D.S. 2002: Ecological assessment of the Pohanga Trust wetland, Awakeri. *Wildland Consultants Ltd Contract Report No. 541*. 10 pp.

Gosling D. 2004: Indigenous vegetation and habitats of the proposed Coastlands West extension, Marlin Drive, Whakatane. *Wildland Consultants Ltd Contract Report No. 906*. Prepared for Lysaght Developments. 6 pp.

Gosling D. 2004: Management plan for restoration plantings at Gordon property – Thornton Road, Matata. *Wildland Consultants Ltd Contract Report No. 952*. Prepared for R.M., J.R. and C. J. Gordon. 6 pp.

Gosling D.S.; Beadel S.M. 2000a: A vegetation survey of coastal kānuka forest between the Rangitaiki and Tarawera Rivers. *Wildland Consultants Ltd Contract Report No. 338*. 45 pp.

Gosling D.S.; Beadel S.M. 2000b: Vegetation and flora of Apanui Saltmarsh, Whakatane Estuary. *Wildland Consultants Ltd Contract Report No. 306*. 22 pp.

Gosling D.S.; Shaw W.B. 1999: Thornton kānuka – landowner views and future management. *Wildland Consultants Ltd Contract Report No. 282*. 35 pp.

Graeme A. 1990: Field trip to Ohinekeao Scenic Reserve and Thornton Recreation Reserve; 16 September 1990. *Rotorua Botanical Society Newsletter 21:* 10.

Hayward B.W.; Vaughan B.; McConchie J. 1988: Landforms and geological features. A case for preservation. Nature Conservation Council, Wellington. 17 pp.

Healy J. 1967: Geological history of the Whakatane District. *Historical Review* (*Whakatane and District Historical Society*) *15(1)*. 9–27.

Healy A.J.; Edgar E. 1980: Flora of New Zealand, Volume III. Government Printer, Wellington, New Zealand. 220 pp.

Healy J.; Schofield J.C. ; Thompson B.N. 1964: Sheet 5 Rotorua (1st edition) Geological Map of New Zealand. 1:250,000. Department of Scientific and Industrial Research. Wellington.

Healy J.; Shaw G.C. 1962: Geology. pp 11–37 *In* National Resources Survey, Part 2 – Bay of Plenty region. Ministry of Works, Wellington. 348 pp.

Healy J.; Vucetich C. G.; Pullar W.A. 1964: Stratigraphy and chronology of late quaternary volcanic ash in Taupo, Rotorua and Gisborne districts. *New Zealand Geological Survey Bulletin N.S. 73*. DSIR, Wellington. 87 pp plus maps.

Heather B.D; Robertson H.A. 2000: The field guide to the birds of New Zealand. Auckland, Viking.

Hermanson A.J. 1999: The effects of fire and grazing on coastal kānuka at Thornton, Eastern Bay of Plenty. *Unpublished Forestry School dissertation, University of Canterbury*. (Copy held by Whakatane District Council.

Hitchmough R., Bull L. and Cromarty P. (comps) 2007: New Zealand Threat Classification System lists – 2005. Department of Conservation, Wellington. 194 pp.

Hobbs J.F.F. 2004: Report on the survey for *Cyclosorus interruptus* and *Thelypteris confluens* in the Tumurau Wetland. Department of Conservation. 23 pp.

Hodgson K.A. and Nairn I.A. 2000: The catastrophic 1350 AD post-eruption flood from Lake Tarawera, New Zealand. *Resource Planning Report 200/01*. Environment BOP, Whakatane. 61 pp.

Holloway J.D.R. (undated): Management Plan for the Wildlife Management Reserves of the Te Teko Ecological District. Eastern Region Fish and Game Council.

Innes J.G.; Hay J.R. 1991: The interactions of New Zealand forest birds with introduced fauna. Pp 2523 – 2533. In "Acta XX Congressus Internationalis Ornithologici Volume IV".

Irving R.M. 1992a: Awaiti Wildlife Management Reserve. In "Irving, R.M. and Beadel, S.M.; Botanical surveys and assessments of wildlife reserves in the Te Teko Ecological District." *Technical Report Series No. 10.* Bay of Plenty Conservancy, Department of Conservation. 198 pp.

Irving R.M. 1992b: Matata Wildlife Management Reserve. In "Irving, R.M. and Beadel, S.M.; Botanical surveys and assessments of wildlife reserves in the Te Teko Ecological District." *Technical Report Series No. 10.* Bay of Plenty Conservancy, Department of Conservation. 198 pp.

Irving R.M. 1992c: Tarawera Cut Wildlife Management Reserve. In "Irving, R.M. and Beadel, S.M.; Botanical surveys and assessments of wildlife reserves in the Te Teko Ecological District." *Technical Report Series No. 10.* Bay of Plenty Conservancy, Department of Conservation. 198 pp.

Irving R.M. 1992d: Bregman Wildlife Management Reserve. In "Irving, R.M. and Beadel, S.M.; Botanical surveys and assessments of wildlife reserves in the Te Teko Ecological District." *Technical Report Series No. 10.* Bay of Plenty Conservancy, Department of Conservation. 198 pp.

Irving R.M. 1992e: Awakaponga Wildlife Management Reserve. In: "Irving, R.M. and Beadel, S.M.; Botanical surveys and assessments of wildlife reserves in the Te Teko Ecological District." *Technical Report Series No. 10.* Bay of Plenty Conservancy, Department of Conservation. 198 pp.

Irving R.M. 1992f: Matuku Wildlife Management Reserve. In: "Irving, R.M. and Beadel, S.M.; Botanical surveys and assessments of wildlife reserves in the Te Teko Ecological District." *Technical Report Series No. 10.* Bay of Plenty Conservancy, Department of Conservation. 198 pp.

Irving R.M. and Beadel S.M. 1992: Botanical surveys and assessments of wildlife reserves in the Te Teko ecological district. *Technical Report Series No. 10.* Bay of Plenty Conservancy, Department of Conservation. 198 pp.

Johnson P. and Brook P. 1989: Wetland plants in New Zealand. DSIR Publishing, Wellington. 319 pp.

Jones K.L. 1991: Māori settlement and horticulture on the Rangitaiki Plains, Bay of Plenty, New Zealand. *New Zealand Journal of Archaeology 13: 143–175.*

Kear D. 1997: Whakatane's geological history. David Kear, Whakatane, NZ. 27 pp.

Kenny J.A.; Hayward B.W. 1992: Inventory of New Zealand Sedimentary Geology Sites of International, National and Regional Significance. *Geological Society of New Zealand Miscellaneous Publication No. 62*. 119 pp.

Kelly G.C. 1980: Landscape and nature conservation. pp 63–87. *In*: "Land alone endures; land use and the role of research" compiled by L.F. Molloy and B.J. Forde, *Department of Scientific and Industrial Research Discussion Paper 3*. 286 pp.

Kuschel G. 1990: Beetles in a suburban environment: a New Zealand case study. *Department of Scientific and Industrial Research Plant Protection Report No. 3.*

Lawlor I. 1980: Radiocarbon dates from Kohika swamp pa (N68/104), Bay of Plenty. *New Zealand Archaeological Association Newsletter 23(4):* 265–267.

Lawlor I. 1983a: Rua kumara o Kawerau. *In* S Bulmer, G. Law and D. Sutton (eds), *A Lot of Spadework to be Done: Essays in Honour of Lady Aileen Fox*, pp 213–48. *New Zealand Archaeological Association Monograph 14.*

Lawlor I. 1983b: Maruka Investigations, Kawerau, Bay of Plenty: Final Report for Stage IV. Department of Anthropology, University of Auckland.

Leathwick J.R.; Clarkson B.D.; Burns B.R.; Innes J.G.; Smale M.C. 1995: Waiapu ecological district. Survey report of the Protected Natural Areas Programme. *New Zealand Protected Natural Areas Programme No. 31.* Department of Conservation, Gisborne. 177 pp.

Leathwick J.R.; Clarkson B.D.; Whaley P.J. 1995: Vegetation of the Waikato region: Current and historical perspective. Landcare Research Contract Report: LC9596/022. 54 pp.

London H.D. 1960: A field Day at Matata. *Historical Review* (*Whakatane and District Historical Society*), 8 (3): 109–14.

McDowall R.M. 1978: New Zealand Freshwater Fishes. A guide and natural history. Heineman Education Books Ltd, Auckland.

McDowall R.M. 1990: New Zealand freshwater fishes. A natural history and guide. Heineman Reed MAF Publishing Group. 553 pp.

McEwen W.M. 1987: Ecological regions and districts of New Zealand. 3rd Revised Edition and 4 1:500,000 Maps. *Biological Resources Centre Publication* No. 5, Department of Conservation, Wellington.

McGlone M.S. 1983: Polynesian deforestation of New Zealand: A preliminary synthesis. *Archaeology in Oceania 18:* 11–25.

McGlone, M. and Pullar, W.A. 1976: More about the Kohika site, Bay of Plenty: soil stratigraphy and pollen analysis. *Historical Review* (*Whakatane and District Historical Society*) 24 (2): 110–13.

McGlone M.S.; Howorth R.; Pullar W.A. 1984: Late Pleistocene stratigraphy, vegetation and climate of the Bay of Plenty and Gisborne regions, New Zealand. *New Zealand Journal of Geology and Geophysics 27:* 327–350.

Mabon, A.D., Pullar, W.A. and Moore, K.W. 1964: Site recording in the Whakatane District. *New Zealand Archaeological Association Newsletter* 7 (1): 29–33.

May B.M. 1993: Larvae of Curculionoidea (Insecta : Coleoptera): a systematic overview. *Fauna of New Zealand 28.* Manaaki Whenua Press, Christchurch, New Zealand. 226 pp.

Mead S.M. 1984: *Te Māori – Māori Art from New Zealand Collections.* (Ed) Heinemann, Auckland.

MfE and DOC 2007a: Protecting our Places. Introducing the national priorities for protecting rare and threatened native biodiversity on private land. Ministry for the Environment and Department of Conservation, Wellington. 7 page brochure.

MfE and DOC 2007b: Protecting our Places. Information about the statement of natural priorities for protecting rare and threatened biodiversity on private land. Ministry for the Environment and Department of Conservation, Wellington. 51 pp.

Miller N.C. 1983a: Awaiti Wildlife Management Reserve – Botanical Survey. *Unpublished Report.* Wildlife Service, Rotorua. 13 pp.

Miller N.C. 1983b: Bregman Wildlife Management Reserve – Botanical Survey. *Unpublished Report.* Wildlife Service. 17 pp.

Miller N.C. 1983c: Matata Wildlife Management Reserve – Botanical Survey. *Unpublished Report.* Wildlife Service. 8 pp.

Miller N.C. 1983d: Proposed wildlife reserve at the Lower Kaituna River. Preliminary botanical report. *Unpublished report.* Wildlife Service, Rotorua. 5 pp.

Ministry of Works 1962: Soils. pp 39–44 *In* National Resources Survey Part 2. Bay of Plenty Region. Government Printer. 348 pp.

Miskelly C. M., Dowding J.E., Elliott G.P., Hitchmough R.A., Powlesland R.G., Robertson H.A., Sagar P.M., Scofield R.P., Taylor G.A. 2008: Conservation status of New Zealand birds, 2008. *Notornis 55*: 117–135.

Mitchell C. P. 1990: Whitebait spawning grounds in the Bay of Plenty. *New Zealand Freshwater Fisheries Miscellaneous Report No. 40*. MAF Fisheries. 19 pp.

Moar N.T.; Cunningham B.T. 1975: Vegetation survey of the Tarawera River and environs, North Island, New Zealand. *New Zealand Journal of Botany 13*: 625–635.

Molloy J., Bell B., Clout M., de Lange P., Gibbs G., Given D., Norton D., Smith N. and Stephens T. 2002: Classifying species according to threat of extinction. A system for New Zealand. *Threatened Species Occasional Publication 22*. Department of Conservation, Wellington. 26 pp.

Molloy J.; Davis A. 1992: Setting priorities for the conservation of New Zealand's threatened plants and animals. Department of Conservation, Wellington. 17 pp.

Molloy J.; Davis A.; Tisdall C. 1994: Setting priorities for the conservation of New Zealand's threatened plants and animals. Second edition. *Department of Conservation, Wellington, New Zealand.* 64 pp.

Molloy L. 1988: Soils in the New Zealand landscape. The Living Mantle. Mallinson Rendel and the New Zealand Society of Soil Science. 239 pp.

Moore K.W. 1973: Archaeology at Whakatane (2 parts). *Historical Review* (*Whakatane and District Historical Society*) *21*(*2*)*:* 113–122 (Whakatane and District Historical Society).

Moore K.W. 1974: Archaeology at Whakatane (2 parts). *Historical Review* (*Whakatane and District Historical Society*) *22*(*1*)*:* 50–63.

Moore K.W. 1976: Rakei Hopukia – N77/4 – Te Teko, Bay of Plenty. *Historical Review* (*Whakatane and District Historical Society*) 24 (2): 103–9.

Moore K.W. 1990: Kawerau. Its History and Background. New Zealand 1990 Official Publication. 194 pp.

Moore L.B.; Edgar E. 1970: *Flora of New Zealand Vol. II*. Government Printer, Wellington. 354 pp.

Myers S.C. 1984: New Zealand Protected Natural Area Programme. Geographic Priorities for future survey. Biological Resources Centre.

Myers S.C. ; Park G.N. and Overmars F.B. 1987: A guidebook for the rapid ecological survey of natural areas. *New Zealand Biological Resources Centre Publication No. 6.* Department of Conservation, Wellington.

Nairn I.A. and Beanland S. 1989: Geology – Edgecumbe earthquake. *New Zealand Journal of Geology and Geophysics 32:1*.

National Institute of Water and Atmospheric Research 1993: Freshwater fish database. Wellington.

New Zealand Meteorological Service 1983a: Summaries of climatological observations to 1980. *New Zealand Meteorological Service Miscellaneous Publication 177*. Government Printer. 172 pp.

New Zealand Meteorological Service 1983b: The climatology of Whakatane Airport. *New Zealand Meteorological Service Miscellaneous Publication 171*(*28*). Government Printer. 20 pp.

New Zealand Society of Soil Science 1974: Soil groups of New Zealand. Pt 1. Yellow-brown pumice soils. Read N.E. (Ed.), Wellington, Government Printer.

New Zealand Soil Bureau 1954: General survey of the soils of North Island, New Zealand. Soil Bureau Bulletin (ns) 5. Government Printer, Wellington.

O'Connor K.F.; Overmars F.B.; Ralston M.M. 1990: Land evaluation for nature conservation. *Conservation Sciences Publication No. 3*, Department of Conservation, Wellington. 328 pp.

O'Donnell C. F.J. 2000: Advances in New Zealand mammalogy 1990–2000: Long-tailed bat. *Journal of Royal Society of New Zealand 31*: 43–57.

Ogle C. C. 1981: The ranking of wildlife habitats. *New Zealand Journal of Ecology 4*: 115–123.

OSNZ 1992: *Notornis 39*: 161–210.

OSNZ 1994a: *Notornis 41*: 1–49.

OSNZ 1994b: *Notornis 41*: 235–274.

OSNZ 1995: *Notornis 42*: 145–173.

OSNZ 1996: *Notornis 43*: 117–145.

OSNZ 1997: *Notornis 44*: 79–109.

OSNZ 1998: *Notornis 45*: 279–309.

OSNZ 2000a: *Notornis 47*: 192–214.

OSNZ 2000b: *Notornis 47*: 215–234.

OSNZ 2001: *Notornis 48:* 165–174.

OSNZ 2006: Classified, summarised notes, BOP/Volcanic Plateau, 1 July 2003 – 30 June 2006. Ornithological Society of New Zealand (OSNZ).

Park S.G. 1991: Bay of Plenty Regional Council coastal overview report. *Technical Publication No. 3*, Bay of Plenty Regional Council, Whakatane. 98 pp.

Partridge T.R. 1992: The sand dune and beach vegetation inventory of New Zealand. *DSIR Land Resources Scientific Report Number 15.* Christchurch.

Pickard C. R.; Towns D.R. 1988: Atlas of the amphibians and reptiles of New Zealand. *Conservation Sciences Publication 1.* Department of Conservation, Wellington.

Pierce R.J. 1999: Regional patterns of migration in the banded dotterel (*Charadrius bicinctus bicinctus*). *Notornis 46*: 101–122.

Pike D. 1991: Watching our wetlands vanish. *Terra Nova.* September 1991. 21–24.

Pillans R.B.; Pullar W.A.; Selby M.J.; Soons J.M. 1985: The age and development of the New Zealand landscape. pp 15–43 *In* Soons J.M. and Selby M.J. (eds). Landforms of New Zealand. Longman Paul Limited. 392 pp.

Pracy L.T. 1962: Introduction and liberation of the opossum (*Trichosurus vulpecula*) into New Zealand. New Zealand Forest Service, Wellington.

Priestley R.; Crozier M.; Hayward B. 1990: New Zealand landform inventory. Second approximation. *Occasional Paper No. 4.* Physical Geography Research School of Earth Sciences, Victoria University.

Pullar 1961: Early Polynesian occupation near Whakatane, Central Bay of Plenty. *New Zealand Archaeological Association Newsletter* 4 (2): 75–77 (reprinted).

Pullar W.A. 1963a: Flood risk at Whakatane. *New Zealand Journal of Hydrology 2*: 47–52.

Pullar W.A. 1963b: River courses and shorelines at Whakatane. *Historical Review* (*Whakatane and District Historical Society*) *11*(*4*): 199–202.

Pullar W.A. 1967: Early Polynesian occupation near Whakatane – an open question?. *New Zealand Archaeological Association Newsletter* 10 (2): 65–66.

Pullar W.A. 1972a: Isopachs of tephra, central North Island, New Zealand. Scale 1:1,000,000. New Zealand Soil Bureau Maps 133/8–14, to accompany New Zealand Soil Survey Report 31. DSIR.

Pullar W.A. 1972b: Soil maps and extended legend of Whakatane Borough and environs, Bay of Plenty, New Zealand. *New Zealand Soil Bureau Publication 515.* 051R.

Pullar W.A. 1973a: Age and distribution of basal tephra marker beds Taupo sheet, New Zealand. Scale 1:250,000. New Zealand Soil Bureau map 131/2, to accompany *New Zealand Soil Survey Report 31.* DSIR.

Pullar W.A. 1973b: Isopachs of tephra, central North Island, New Zealand. Scale 1:1,000,000. New Zealand Soil Bureau maps 133/1–7, 138/8–14. In *New Zealand Soil Survey Report 1.* DSIR.

Pullar W.A. 1985: Soils and land use of Rangitaiki Plains, North Island, New Zealand. *Soil Survey Report 86.* DSIR, Wellington.

Pullar W.A.; Birrell K.S. 1973: Age and distribution of late Quaternary pyroclastic and associated cover deposits of the Rotorua and Taupo area, North Island, New Zealand. *New Zealand Soil Survey Report 1.* DSIR Wellington.

Pullar W.A.; Birrell K.S.; Heine J.C. 1973: Explanatory notes to accompany *New Zealand Soil Survey Reports 1 and 2.* Soil Bureau, DSIR Wellington.

Pullar W.A.; Hewitt S.R.; Heine J.C. 1978: Soils and land use of Whakatane Borough and environs, Bay of Plenty, New Zealand. *Soil Bureau Bulletin 38.* DSIR, Wellington. 100 pp plus maps.

Pullar W.A.; Patel R.N. 1972: Identification of tree stumps and driftwood associated with tephra layers in alluvium, peat, and dune sands. *New Zealand Journal of Botany 10*: 605–614.

Pullar W.A.; Selby M.J. 1971: Coastal progradation of Rangitaiki Plains, New Zealand. *New Zealand Journal of Science 14*: 419–434.

Quayle A.M. 1984: The climate and weather of the Bay of Plenty Region. *New Zealand Meteorological Service Miscellaneous Publication 115(1)*. 56 pp.

Ramsay G.W.; Meads M.J.; Sherley G.H.; Gibbs G.W. 1988: Research on terrestrial insects of New Zealand. Wildlife Research Liaison Group, *Research Review No. 10*. 49 pp.

Rasch G. 1989: Wildlife and wildlife habitat in the Bay of Plenty Region. *Regional Report Series No. 11*. Department of Conservation, Rotorua. 136 pp.

Read N.E. (ed) 1974: Soil groups of New Zealand. Part 1: Yellow-brown pumice soils. *New Zealand Society of Soil Science Publication*. Government Printer. 251 pp.

Ryan C. P.; Beadel S.M.; Gosling D.S. 1999: Environmental Pest Plants in the Whakatane Field Centre. *Wildland Consultants Ltd Contract Report No. 259*. Prepared for Department of Conservation. 501 pp (2 volumes).

Saxton B.A.; Rower D.K.; Stancliff A.G. 1987: Species composition and relative importance of whitebait fisheries in 13 Bay of Plenty rivers. *Fisheries Environmental Report No. 79*. MAFFISH.

Shaw W.B. 1994: Botanical ranking for nature conservation. *Science and Research Series No. 72*. Department of Conservation, Wellington. 17 pp.

Shaw W.B. 1996: Wildlife of the Kopuatawhiti Wetland, Rangitaiki Plains. *Wildland Consultants Ltd Contract Report No. 170*. 7 pp.

Shaw W.B. 1997: Vegetation survey and monitoring in Whakatane Field Centre. *Wildland Consultants Ltd Contract Report No. 188*. 141 pp

Shaw W.B. 1988: Botanical conservation assessment of Crown lands in the Urewera/ Raukumara planning study area. *Project Record No. 2035*. Forest Research Institute, Rotorua. 140 pp.

Shaw W.B. 1998: Management of the margins of lakes, freshwater wetlands and estuarine margins in New Zealand. *Wildland Consultants Ltd Contract Report No. 219*.

Shaw W.B. 2002: Overview of ecosystems, habitats and species, and threats to indigenous biodiversity in the Bay of Plenty region. *Wildland Consultants Ltd Contract Report No. 537*. 8 pp.

Shaw W.B. 2003: Ecological assessment of a proposal to alter water inflows to the Tumurau Wetland. *Wildland Consultants Ltd Contract Report No. 623*. Prepared for Beca Consulting. 9 pp.

Shaw W.B.; Allen R.B. 2002: Ecological impacts of sea couch and salt water paspalum in Bay of Plenty estuaries. *Wildland Consultants Ltd Contract Report No. 500*. Prepared for Department of Conservation. 14 pp.

Shaw W.B. and Beadel S.M. 1997: Vascular plant taxa of conservation concern in Whakatane Field Centre – a review. *Wildland Consultants Ltd Contract Report No. 186*. 24 pp.

Shawcross F.W. 1965: Report on archaeological investigations at Thornton, Whakatane, Bay of Plenty. *Historical Review* (*Whakatane and District Historical Society*) 12 (3 & 4): 186–192.

Smale M.C. 1979: White Pine Bush: The synecology of an alluvial kahikatea forest. *Unpublished dissertation*. Canterbury University, Christchurch. 36 pp plus appendices.

Smale M.C. 1984: White Pine Bush: An alluvial kahikatea (*Dacrycapus dacrydioides*) forest remnant, Eastern Bay of Plenty, New Zealand. *New Zealand Journal of Botany 22*: 201–206.

Smale M.C. 1990: Ecology, succession, and conservation of coastal kānuka communities in Eastern Bay of Plenty. *Forest Research Institute Contract Report FWE 90/28* prepared for Department of Conservation, Wellington.

Smale M.C. 1994: Structure and dynamics of kānuka (*Kunzea ericoides* var. *ericoides*) heaths on sand dunes in Bay of Plenty, New Zealand. *New Zealand Journal of Botany 32*: 441–452.

Soons J.M.; Selby M.J. (Editors), 1982: Landforms of New Zealand. Longman Paul Limited, Auckland.

Stephenson G. 1986: Wetlands. Discovering New Zealand's shy places. Government Printer, Wellington. 117 pp.

Stevenson G.K. (Convenor) 1983: Wetlands: a diminishing resource. A report for the Environment Council. *NWASCO Water and Soil Publication No. 58*. 62 pp plus plates and appendices.

Stirling M.W. 1988: Inventory of New Zealand Active Earth Deformation Sites. *Geological Society of New Zealand Miscellaneous Publication No. 38*. 85 pp.

Strickland R.R. 1993: Fisheries aspects of the Matata Lagoon. *Unpublished report*. River, Lake & Sea. Prepared for the Department of Conservation. 12 pp.

Townsend A.J., de Lange P.J., Duffy C. A., Miskelly C. M., Molloy J., and Norton D.A. 2008: New Zealand threat classification system manual. Department of Conservation, Wellington. 35 pp.

Vucetich C. G.; Pullar W.A. 1964: Stratigraphy of Holocene ash in the Rotorua and Gisborne districts. *New Zealand Geological Survey Bulletin 73* (Part 2), New Zealand Department of Science and Industrial Research, Wellington.

Wardle P. 1991: Vegetation of New Zealand. Cambridge University Press.

Watt J.C. 1975: The terrestrial insects. Pp. 507–535 *in* Kuschel, G. (Ed.). Biogeography and Ecology in New Zealand. Dr W. Junk B.V. Publishers, The Hague.

Watt J.C. 1982: New Zealand beetles. *New Zealand Entomologist 7:3*. 213–221.

Webb C. J.; Sykes W.R. and Garnock-Jones P.J. 1988: Flora of New Zealand. Volume IV. Botany Division, DSIR, Christchurch. 1365 pp.

Whakatane District Council 1986: Western Whakatane Coastal Recreation Reserves Management Plan. 128 pp.

Whakatane District Council 1998: Proposed Whakatane District Plan (Rural). 296 pp plus appendices.

Whaley K.J.; Clarkson B.D. and Leathwick J.R. 1995: Assessment of criteria used to determine 'significance' of natural areas in relation to section 6(c) of the Resource Management Act (1991). Landcare Research Contract Report prepared for Environment Waikato, Hamilton.

Whitaker A.H. 1973: Lizard populations on islands with and without Polynesian rats, *Rattus exulans* (Peale). *Proceedings of the New Zealand Ecological Society 20:* 121–130.

Wildland Consultants 1999: Thornton kānuka – landowner views and future management—landowner interview responses. *Wildland Consultants Ltd Contract Report No. 310*. 128 pp

Wildland Consultants 2000a: Norske Skog Tasman–Wildlands restoration and management plan. *Wildland Consultants Ltd Contract Report No. 322*. Prepared for Norske Skog Tasman Ltd. 115 pp.

Wildland Consultants 2000b: Awaiti Wildlife Management Reserve – management guidelines. *Wildland Consultants Ltd Contract Report No. 347*.

Wildland Consultants 2001a: Restoration proposal for Tarawera River–Kawerau Bridge to Kawerau Airstrip. *Wildland Consultants Ltd Contract Report No. 431*. Prepared for Norske Skog Tasman, Carter Holt Harvey Paper, Carter Holt Harvey Tissue, Keep Kawerau Beautiful Committee, Fletcher Challenge Forests. 46 pp.

Wildland Consultants 2001b: Vegetation map and descriptions of Awaiti Wildlife Management Reserve. *Unpublished report*.

Wildland Consultants 2001c: Privately owned natural areas worthy of protection in the Bay of Plenty (BOP) Region. *Wildland Consultants Ltd Contract Report No. 370*. 16 pp.

Wildland Consultants 2001d: Avifauna of the Western Whakatane Coastal Recreation Reserves. *Wildland Consultants Ltd Contract Report No. 441*. Prepared for Whakatane District Council. 16 pp.

Wildland Consultants 2002: Ecological restoration of wetlands on the Rangitaiki Plains – Tumurau Lagoon Conservation Covenant, Tarawera Cut Wildlife Management Reserve, Matata Wildlife Refuge, Thornton Lagoon Wildlife Management Reserve, Awaiti Wildlife Management Reserve, Lake Tamurenui Wildlife Management Reserve, Bregman Wildlife Management Reserve. *Wildland Consultants Ltd Contract Report No. 527*. Prepared for Department of Conservation, Whakatane. 128 pp.

Wildland Consultants 2003: Environment BOP freshwater wetland database – Revision and expansion. *Wildland Consultants Ltd Contract Report No. 647*. Prepared for Environment BOP. 29 pp.

Wildland Consultants 2004: Landscape effects of a proposed subdivision at Withy Road, Awakaponga. *Wildland Consultants Ltd Contract Report No. 972*. Prepared for R.J. Overington. 26 pp.

Wildland Consultants 2005a: Baseline survey of vegetation and flora for the Ohinemataroa Awa Restoration Plan. *Wildland Consultants Ltd Contract Report No. 683*. Prepared for Ohinemataroa River Management Committee. 28 pp.

Wildland Consultants 2005b: Digital mapping of geothermal vegetation in the Bay of Plenty Region - based on 1995 aerial photographs. *Wildland Consultants Ltd Contract Report No. 1056*. Prepared for Environment BOP. 14 pp.

Wildland Consultants 2006a: Ecological restoration plan for Lake Pupuwharau, Kawerau. *Wildland Consultants Ltd Contract Report No. 1183*. Prepared for Te Rangitupukiwaho–Kanui Waitere–Wetini Whanau Trust. 30 pp.

Wildland Consultants 2006b: Assessment of landscape and visual effects for a proposed subdivision, Hogbin Road, Te Teko. *Wildland Consultants Ltd Contract Report No. 1334*. Prepared for Ross Overington. 17 pp.

Wildland Consultants 2006c: Significant indigenous vegetation and significant habitats of indigenous fauna in the coastal environment of the Bay of Plenty Region. *Wildland Consultants Ltd Contract Report No. 1345*. Prepared for Environment BOP. Volume 1 – 553 pp, Volume 2 – maps 49 pp.

Wildland Consultants 2007a: Significant indigenous vegetation and significant habitats of indigenous fauna in the coastal environment of the Bay of Plenty Region - addendum to 2006 report. *Wildland Consultants Ltd Contract Report No. 1742*. Prepared for Environment Bay of Plenty. 74 pp.

Wildland Consultants 2007b: Comments on the application for resource consent to Whakatane District Council. *Wildland Consultants Ltd Contract Report No. 1750*. Prepared for P.A. Roling, Coastlands, Whakatane. 2 pp. (Draft).

Wildland Consultants 2007c: Assessment of proposed removal of trees, King Street, Kopeopeo, Whakatane. *Wildland Consultants Ltd Contract Report No. 1855*. Prepared for Chris Mortimer, C/- RPC Consultants Ltd. 11 pp.

Wildland Consultants 2008a: Landscape and ecological assessment of a proposed subdivision at 1030 Thornton Road, Rangitaiki Plains. *Wildland Consultants Ltd Contract Report No. 1935*. Prepared for Andrew and Helen Smith. 22 pp.

Wildland Consultants 2008b: Ecological and landscape assessment of a proposed subdivision at 990A Thornton Road, Rangitaiki Plains. *Wildland Consultants Ltd Contract Report No. 1983*. Prepared for Mr Jack Turner. 23 pp.

Wildland Consultants 2008c: Ecological restoration enhancement of the Turner property at 990A Thornton Road, Rangitaiki Plains. *Wildland Consultants Ltd Contract Report No. 1983a*. Prepared for Mr Jack Turner. 10 pp.

Wildland Consultants 2008d: Ecological assessment of a proposed extension to Thornton Beach Holiday Park, Thornton Beach. *Wildland Consultants Ltd Contract Report No. 2010*. Prepared for Harrison Grierson Consultants Ltd. 8 pp.

Wildland Consultants Ltd 2008e: Ecological assessment of a proposed subdivision at 166 Braemar Road, Whakatane District. *Wildland Consultants Ltd Contract Report No. 2054*. Prepared for Ross Overington Surveyors Ltd. 10 pp.

Wildland Consultants 2008f: Ecological enhancement of 1030 Thornton Road, Rangitaiki Plains. *Wildland Consultants Ltd Contract Report No. 2060*. Prepared for Andrew & Helen Smith. 13 pp.

Wildland Consultants 2011: Vegetation and habitats of Kopuatawhiti Wetland, Matata. *Wildland Consultants Ltd Contract Report No. 2698*. Prepared for Bay of Plenty Regional Council. 28 pp.

Williams P.A. 1988: Death of *Lupinus arboreus*. *New Zealand Botanical Society Newsletter 12:* 12.

Williams G.R.; Given D.R. 1981: The Red Data Book of New Zealand. Nature Conservation Council, Wellington, New Zealand. 175 pp.

Williams S. 1999: Tumurau (Braemar) Lagoon Management Guidelines. Prepared for Department of Conservation. 44 pp.

Wilson C. M. and Given D.R. 1989: Threatened plants of New Zealand. DSIR Publishing Wellington. 151 pp.

Wodzicki K.A. 1950: Introduced animals of New Zealand. N.Z. Department of Scientific and Industrial Research, Wellington.

Worthy T.H.; Holdaway R.N.; Morris R. 2002: The Lost World of the Moa: Prehistoric life of New Zealand. Indiana University Press. 718 pp.

Young A; Mitchell N. 1994: Microclimate and vegetation edge effects in a fragmented podocarp-broadleaf forest in New Zealand. *Biological Conservation 67*. 63–72.

Appendix 1

Checklist of indigenous vascular plants in Te Teko Ecological District

The following list is compiled from current survey, previous ecological surveys by the authors and Beadel *et al.* 1996b and c; unless otherwise quoted (e.g. herbarium voucher numbers).

Nomenclature follows Allan (1961), Moore and Edgar (1976), Healy and Edgar (1980), Brownsey, Given and Lovis (1985), Connor and Edgar (1987), and Webb, Sykes and Garnock-Jones (1988).

Abbreviations used

aff.	:	affinities with
agg.	:	aggregate, comprising more than one species.
cf.	:	compare with
f.	:	forma, form
incl.	:	including
sp.	:	species (singular)
spp.	:	species (plural)
subsp.	:	subspecies
s.s.	:	*sensu stricto*, in the narrow sense
x	:	hybrid
var	:	variety
*	:	possibly naturalised

INDIGENOUS SPECIES

Gymnosperms

Dacrycarpus dacrydioides	kahikatea
Dacrydium cupressinum	rimu
Podocarpus tōtara var. *tōtara*	tōtara
Prumnopitys ferruginea	miro

Monocot. trees and shrubs

Cordyline australis	tī kōuka, cabbage tree
Cordyline banksii	tī ngahere, forest cabbage tree

Dicot. trees and shrubs

Alectryon excelsus subsp. *excelsus*	tītoki
Aristotelia serrata	makomako, wineberry
Beilschmiedia tawa	tawa
Brachyglottis repanda	rangiora
Carmichaelia australis	mākaka, maukoro
Coprosma acerosa s.s	sand coprosma, tarakupenga
Coprosma ×cunninghamii	
Coprosma lucida	karamū, glossy karamū

Coprosma propinqua var. *propinqua*	mingimingi
Coprosma repens	taupata
Coprosma robusta	karamū
Coprosma tenuicaulis	hukihuki, swamp coprosma
Coriaria arborea var. *arborea*	tutu
Corynocarpus laevigatus	karaka
Dodonaea viscosa	akeake
Elaeocarpus hookerianus	pōkākā
Entelea arborescens	whau
Fuchsia excorticata	kōtukutuku
Gaultheria antipoda	tāwiniwini
Geniostoma ligustrifolium var. *ligustrifolium*	hangehange
Griselinia lucida	puka
Hebe parviflora	koromiko-tāranga
Hebe stricta var. *stricta*	koromiko
Hedycarya arborea	porokaiwhiri
Knightia excelsa (Hobbs 2004)	rewarewa
Korthalsella salicornioides (P. Cashmore pers. comm.)	
Kunzea ericoides var. *microflora*	prostrate kānuka
Kunzea aff. *ericoides* (b)	kānuka
Kunzea aff. *ericoides* (d)	Thornton kānuka
Kunzea ericoides (b) × *Kunzea ericoides* (c) (AK 289951)	
Kunzea aff. *ericoides* (b) × *K.* aff. *ericoides* (d) (P. de Lange pers. comm.)	
Laurelia novae-zelandiae	pukatea
Leptecophylla juniperina var. *juniperina*	prickly mingimingi
Leptospermum scoparium agg.	mānuka
Leucopogon fasciculatus	mingimingi
Leucopogon fraseri	patōtara
Litsea calicaris	mangeao
Macropiper excelsum subsp. *excelsum*	kawakawa
Melicytus novae-zelandiae	coastal māhoe
Melicytus ramiflorus subsp. *ramiflorus*	māhoe
Metrosideros excelsa	pōhutukawa
Myoporum laetum	ngaio
Myrsine australis	māpou
Ozothamnus leptophyllus	tauhinu
Pimelea tomentosa	
Pittosporum crassifolium	karo
Pittosporum eugenioides	tarata
Pittosporum tenuifolium	kōhūhū
Plagianthus divaricatus	marsh ribbonwood mākaka
Pseudopanax arboreus	whauwhaupaku, five finger
Schefflera digitata	patē
Weinmannia racemosa	kāmahi

Monocot. lianes

Freycinetia banksii	kiekie

Dicot. lianes

Calystegia sepium subsp. *roseata*	pōhue
Calystegia soldanella	panahi, shore bindweed

Clematis cunninghamii	ngākau-kiore
Clematis paniculata	puawānanga
Metrosideros fulgens	rātā vine
Metrosideros perforata	aka
Muehlenbeckia australis	puka
Muehlenbeckia complexa	pōhuehue
Muehlenbeckia australis × *M. complexa*	
Parsonsia capsularis	akakiore
Parsonsia heterophylla	akakaikiore
Sicyos aff. *australis* (b)	mawhai

Lycopods and psilopsids

Huperzia varia	Whiri-o-Raukatauri
Lycopodiella cernua	maatukutuku
Lycopodium volubile	waewaekoukou

Ferns

Adiantum cunninghamii	common maidenhair
Asplenium bulbiferum	mouku, hen and chicken fern
Asplenium flaccidum	makawe
Asplenium oblongifolium	huruhuruwhenua
Asplenium polyodon	petako
Asplenium bulbiferum × *A. flaccidum*	petako-pāraharaha
Azolla filiculoides	retoreto
Blechnum chambersii	rereti
Blechnum discolor	petipeti, crown fern
Blechnum filiforme	panako
Blechnum fluviatile	kiwakiwa
Blechnum minus	swamp kiokio
Blechnum novae-zelandiae	kiokio
Blechnum penna-marina subsp. *alpina*	
Blechnum minus × *B. novae-zelandiae*	
Ctenopteris heterophylla	
Cyathea dealbata	ponga, silver fern
Cyathea medullaris	
Cyclosorus interruptus	
Deparia petersenii subsp. *congrua*	
Dicksonia squarrosa	whekī
Dicranopteris linearis	
Diplazium australe	
Doodia australis	pukupuku
Gleichenia dicarpa	tangle fern
Gleichenia microphylla	waewaekaka, swamp umbrella fern
Histiopteris incisa	matata, water fern
Hymenophyllum demissum	irirangi, filmy fern
Hymenophyllum dilatatum	matua mauku, filmy fern
Hymenophyllum scabrum (Hobbs 2004)	mauku, filmy fern
Hypolepis ambigua	
Hypolepis distans	
Lastreopsis velutina	
Lygodium articulatum	mangemange
Microsorum pustulatum	kōwaowao, hound's tongue fern

Microsorum scandens	fragrant fern
Paesia scaberula	matata
Pneumatopteris pennigera	pakau
Polystichum neozelandicum subsp. *neozelandicum* (Hobbs 2004)	pikopiko, shield fern
Pteridium esculentum	rarahu, bracken
Pteris tremula	turawera, shaking brake
Pyrrosia eleagnifolia	leather-leaf fern
Rumohra adiantiformis	
Thelypteris confluens	
Tmesipteris elongata	fork fern

Orchids

Diplodium alobulum	
Drymoanthus adversus (Hobbs 2004)	
Gastrodia sp.	
Microtis unifolia agg.	māikaika
Pterostylis aff. *graminea*	
Pterostylis aff. *montana* agg.	
Thelymitra longifolia	maikuku

Grasses

Austrofestuca littoralis (NZFRI 2500)[11]	sand tussock, hinarepe
Cortaderia fulvida	toetoe
Cortaderia toetoe	toetoe
Deyeuxia avenoides	
Dichelachne crinita	pātītī, plume grass
Isachne globosa	swamp millet
Lachnagrostis billardierei	perehia
Lachnagrostis filiformis	perehia
Microlaena stipoides	pātītī, meadow rice grass
Oplismenus hirtellus subsp. *imbecillis*	
Rytidosperma gracile	
Spinifex sericeus	kōwhangatara, spinifex

Sedges

Baumea arthrophylla	
Baumea articulata	
Baumea juncea	
Baumea rubiginosa	
Baumea tenax	
Baumea teretifolia	
Bolboschoenus caldwellii	purua grass
Bolboschoenus fluviatilis	purua grass
Bolboschoenus medianus	purua grass
Carex aff. *raoulii* (“raotest”)	
Carex breviculmis	
Carex fascicularis	sedge
Carex geminata agg.	rautahi
Carex lessoniana (AK 270394)	toetoe-rautahi
Carex maorica	

11 1949 record from Matata; no recent records from the ecological district.

Carex pumila	
Carex secta	pūrei
Carex subdola	
Carex testacea	
Carex virgata	pūrei
Cyperus ustulatus f. *ustulatus*	toetoe, upokotangata
Desmoschoenus spiralis	pīngao
Eleocharis acuta	
Eleocharis gracilis	
Eleocharis sphacelata	giant spike sedge, ngawha
Ficinia nodosa	wīwī
Isolepis cernua	
Isolepis distigmatosa	
Isolepis habra	
Isolepis prolifera	
Isolepis reticularis	
Lepidosperma australe	
Morelotia affinis	
Schoenoplectus pungens	
Schoenoplectus tabernaemontani	kāpūngāwhā
Schoenus maschalinus	
Tetraria capillaris	
Uncinia uncinata (Hobbs 2004)	kamu matau a Maui

Rushes

Apodasmia similis	oioi
Empodisma minus	wire rush
Juncus edgariae	wī
Juncus kraussii var. *australiensis*	wī, sea rush
Juncus pallidus	wī
Juncus planifolius	
Juncus prismatocarpus	
Juncus sarophorus	wī
Luzula picta var. *picta*	

Monocot. herbs (other than orchids, grasses, sedges, and rushes)

Dianella haematica	
Dianella nigra	tūrutu
Lemna minor	kārearea
Phormium tenax	harakeke, flax
Potamogeton cheesemanii	mānihi
Potamogeton ochreatus	
Ruppia sp.	
Sparganium subglobosum	maru, burr reed
Triglochin striata	arrow grass
Typha orientalis	raupō
Wolffia australiana	

Composite herbs

Cotula coronopifolia	bachelor's button
Euchiton collinus	
Euchiton involucratus	
Euchiton limosus	

Euchiton sphaericus	
Pseudognaphalium luteoalbum agg.	
Senecio biserratus	
Senecio glomeratus (NZFRI 26596)	
Senecio minimus	

Dicot. herbs (other than composites)

Acaena anserinifolia (NZFRI 2502)	piripiri
Acaena novae-zelandiae	piripiri
Apium prostratum subsp. *prostratum* var. *filiforme*	tūtae-kōau, New Zealand celery
Callitriche muelleri	
Callitriche petriei subsp. *petriei*	
Callitriche stagnalis	starwort
Cardamine sp. (*C. debilis* agg. "long style")	panapana
Centella uniflora	
Drosera binata	sundew, wahu
Elatine gratioloides	
Epilobium chionanthum	
Epilobium pallidiflorum	tawarewa
Epilobium chionanthum × *E. pallidiflorum*	
Galium propinquum	māwe
Geranium solanderi	matūīa-kumara
Gonocarpus micranthus	piripiri
Haloragis erecta subsp. *erecta*	toatoa
Hydrocotyle novae-zeelandiae var. *novae-zeelandiae*	
Hydrocotyle pterocarpa	
Lilaeopsis novae-zelandiae	
Lobelia anceps	punakuru
Lobelia angulata	pānakenake
Myriophyllum propinquum	
Myriophyllum triphyllum	
Nertera depressa	
Nertera scapanioides	
Oxalis rubens	sand oxalis
Parietaria debilis	
Pelargonium inodorum	kōpata
Persicaria decipiens	tutunāwai
Ranunculus amphitrichus	kawariki
Ranunculus reflexus	maruru
Samolus repens var. *repens*	makaokao
Sarcocornia quinqueflora	ureure, glasswort
Selliera radicans	remuremu
Solanum americanum	raupeti
Suaeda novae-zelandiae (Irving 1991)	
Tetragonia tetragonioides	kōkihi
Utricularia australis[12]	

12 Not recorded in Te Teko Ecological District since the 1960s.

Appendix 2

Checklist of naturalised vascular plants in Te Teko Ecological District

(From current survey and Beadel 1992a, 1993b, 1994a&b unless otherwise quoted)

NATURALISED SPECIES

Gymnosperms

Pinus pinaster	maritime pine
Pinus radiata	radiata pine

Monocot. trees and shrubs

Agave americana (NZFRI 27001)	century plant
Phoenix canariensis	Phoenix palm
Yucca gloriosa	yucca

Dicot. trees and shrubs

Acacia decurrens	green wattle
Acacia floribunda	gossamer wattle
Acacia longifolia	Sydney golden wattle
Acacia mearnsii	black wattle
Acacia melanoxylon	Tasmanian blackwood
Acacia pravissima	ovens wattle
Acacia verticillata	prickly Moses
Acer pseudoplatanus	sycamore maple
Alnus glutinosa	common alder
Berberis glaucocarpa	barberry
Buddleja davidii	buddleia
Casuarina cunninghamiana	sheoak, common river oak
Casuarina glauca	swamp oak
Chamaecytisus palmensis	tree lucerne
Cotoneaster glaucophyllus	cotoneaster
Crataegus monogyna	hawthorn
Cytisus scoparius	wild broom
Elaeagnus ×reflexa	elaeagnus
Erica lusitanica	Spanish heath
Eriobotrya japonica (AK 272184)	loquat
Eucalyptus leucoxylon (AK 272162)	whitewood
Feijoa sellowiana	feijoa
Ficus carica	fig
Hypericum androsaemum	tutsan
Juglans regia (AK 278244)	common walnut
Ligustrum lucidum	tree privet
Ligustrum sinense	Chinese privet
Lupinus arboreus	lupin
Lycium ferocissimum	boxthorn
Malus ×domestica	apple tree
Myoporum laetum × *M.* aff. *insulare*	

Paraserianthes lophantha	brush wattle
Populus yunnanensis	Yannan poplar
Populus alba 'Nivea'	silver poplar
Populus nigra 'Italica'	Lombardy poplar
Prunus×domestica (Hobbs 2004)	plum
Quercus ilex (NZFRI 27052)	holm oak
Quercus robur (NZFRI 27338)	English oak
Ricinus communis	castor oil plant
Robinia pseudoacacia (Department of Conservation Weed Database, March 2009)	false acacia, black locust
Rosa rubiginosa	sweet briar
Rubus fruticosus agg.	blackberry
Rubus idaeus	raspberry
Rubus phoenicolasius	Japanese wineberry
Salix babylonica	weeping willow
Salix cinerea	grey willow
Salix fragilis	crack willow
Salix matsudana 'Tortuosa'	tortured willow
Senecio angulatus	Cape ivy
Solanum mauritianum	woolly nightshade
Solanum pseudocapsicum	Jerusaleum cherry
Tecomaria capensis	Cape honeysuckle
Ulex europaeus	gorse

Monocot. lianes

Asparagus asparagoides (AK 236781)	smilax

Dicot. lianes

Araujia sericifera	moth plant
Celastrus orbiculatus (Department of Conservation Weed Database, March 2009)	climbing spindle berry
Clematis vitalba (Department of Conservation Weed Database, March 2009)	old man's beard
Dipsacus sylvestris	wild teasel
Hedera helix	ivy
Jasminum polyanthum	jasmine
Lonicera japonica	Japanese honeysuckle
Passiflora caerulea	blue-crown passion flower
Sechium edule (NZFRI 25218)	choko
Vinca major	periwinkle
Vitis vinifera (NZFRI 27342)	grape

Ferns

Azolla pinnata	ferny azolla
Nephrolepis cordifolia	tuber ladder fern
Osmunda regalis	royal fern

Grasses

Agrostis capillaris	browntop
Agrostis stolonifera	creeping bent
Aira caryophyllea subsp. *caryophyllea*	silver hairy grass
Alopecurus geniculatus	kneed foxtail

Ammophila arenaria	marram
Anthoxanthum odoratum	sweet vernal
Arrhenatherum elatius subsp. *bulbosum*	onion twitch
Avena barbata	slender oat
Avena fatua	wild oat
Axonopus fissifolius	narrow-leaved carpet grass
Briza maxima	large quaking grass
Briza minor	shivery grass
Bromus diandrus	ripgut brome
Bromus hordeaceus	soft brome
Bromus willdenowii	prairie grass
Cortaderia jubata	purple pampas grass
Cortaderia selloana	pampas grass
Cynodon dactylon	Indian doab
Cynosurus cristatus	crested dogstail
Dactylis glomerata	cocksfoot
Digitaria sanguinalis	summer grass
Echinochloa crus-galli	barnyard grass
Echinochloa crus-pavonis (AK 271709)	gulf barnyard grass
Ehrharta erecta	veldt grass
Eleusine indica	crowfoot grass
Elytrigia pycnantha	sea couch
Eragrostis brownii	bay grass
Festuca rubra subsp. *commutata*	chewings fescue
Festuca rubra subsp. *rubra*	red fescue
Glyceria declinata	blue sweetgrass
Glyceria fluitans	floating sweetgrass
Glyceria maxima	reed sweetgrass
Holcus lanatus	Yorkshire fog
Lagurus ovatus	harestail
Lolium perenne	rye grass
Miscanthus nepalensis	Himalaya fairy grass
Panicum dichotomiflorum	smooth witchgrass
Paspalum dilatatum	paspalum
Paspalum distichum	Mercer grass
Pennisetum clandestinum	kikuyu grass
Phalaris aquatica	phalaris
Phleum pratense	timothy
Poa annua	annual poa
Poa pratensis	Kentucky bluegrass
Pseudosasa japonica	arrow bamboo
Schedonorus arundinaceus	tall fescue
Setaria pumila (NZFRI 26985)	yellow bristle grass
Setaria viridis	green bristle grass
Sorghum bicolor (AK 216539)	gorage sorghum
Sporobolus africanus	ratstail
Vulpia myuros var. *megalura*	vulpia hair grass

Sedges

Carex divulsa	grey sedge
Carex lurida	sallow sedge
Carex ovalis	oval sedge

Carex vulpinoidea (AK 271710)	fox sedge
Cyperus congestus	purple umbrella sedge
Cyperus eragrostis	umbrella sedge
Cyperus esculentus (AK 303721)	yellow nut grass
Isolepis sepulcralis	

Rushes

Juncus acuminatus	sharp-fruited rush
Juncus articulatus	jointed rush
Juncus bufonius var. *bufonius*	toad rush
Juncus bulbosus	bulbous rush
Juncus effusus var. *effusus*	soft rush, leafless rush
Juncus microcephalus	South American rush
Juncus procerus	giant rush
Juncus tenuis var. *tenuis*	track rush

Monocot. herbs (other than orchids, grasses, sedges, and rushes)

Agapanthus praecox	agapanthus
Alisma plantago-aquatica	water plantain
Allium triquetrum	onion weed
Alocasia brisbanensis	elephants ears
Arum italicum	Italian arum
Asparagus officinalis	asparagus
Canna indica	canna lily, Indian shoot
Crocosmia ×crocosmiiflora	montbretia
Egeria densa	egeria
Eichhornia crassipes (Department of Conservation Weed Database, March 2009)	water hyacinth
Elodea canadensis	Canadian pondweed
Freesia refracta	freesia
Gladiolus undulatus	gladiolus
Hedychium flavescens	wild ginger, yellow ginger
Hedychium gardnerianum	kahili ginger, wild ginger
Iris foetidissima	stinking iris
Landoltia punctata	purple-backed duckweed
Potamogeton crispus)	curly pondweed
Tradescantia fluminensis	tradescantia
Zantedeschia aethiopica	arum lily
Zantedeschia aethiopica 'Green Goddess'	green goddess

Composite herbs

Achillea millefolium	yarrow
Anthemis cotula	stinking mayweed
Arctotheca calendula	cape weed
Artemisia verlotiorum	Chinese mugwort
Aster subulatus	sea aster
Bellis perennis	lawn daisy
Bidens frondosa	beggars' ticks
Carduus tenuiflorus	winged thistle
Carthamus lanatus (AK 217800)	woolly safflower
Cichorium intybus	chicory
Cirsium arvense	California thistle

Cirsium vulgare	Scotch thistle
Conyza sumatrensis	broad-leaved fleabane
Crepis capillaris	hawksbeard
Gaillardia ×grandiflora	gaillardia
Gamochaeta coarctata	purple cudweed
Hypochoeris radicata	catsear
Jacobaea vulgaris	ragwort
Lactuca serriola	prickly lettuce
Lactuca virosa (NZFRI 27374)	acrid lettuce
Lapsana communis	nipplewort
Leontodon taraxacoides	hawkbit
Leucanthemum vulgare	oxeye daisy
Mycelis muralis	wall lettuce
Osteospermum fruticosum	rain daisy, dimorphotheca
Senecio bipinnatisectus	Australian fireweed
Senecio elegans	purple groundsel
Senecio skirrhodon	gravel groundsel
Solidago canadensis (NZFRI 26921)	golden-rod
Sonchus asper	prickly puha
Sonchus oleraceus	puha, sow thistle
Taraxacum officinale	dandelion
Xanthium spinosum (NZFRI 11141)	Bathurst bur

Dicot. herbs (other than composites)

Alyssum sp.	madwort
Amaranthus deflexus (NZFRI 27359)	prostrate amaranth
Amaranthus powellii	redroot
Amaranthus retroflexus	redroot
Anagallis arvensis	scarlet pimpernel
Aphanes arvenis	parsley piert
Atriplex prostrata	orache
Brassica rapa subsp. *sylvestris*	wild turnip
Cakile maritima	sea rocket
Cardamine hirsuta (AK 270281)	bitter cress
Cardamine pratensis	cuckoo cress
Carpobrotus edulis	ice plant
Ceratophyllum demersum	hornwort
Chenopodium album	fathen
Chenopodium ambrosioides	Mexican tea
Conium maculatum	hemlock
Crassula alata (AK 289819)	
Crassula muscosa (AK 289820)	rattail crassula
Daucus carota	wild carrot
Delairea odorata	German ivy
Digitalis purpurea	foxglove
Duchesnea indica	Indian strawberry
Echium vulgare	viper's bugloss
Epilobium ciliatum	tall willow herb
Erechtites hieraciifolia	American fireweed
Erodium moschatum (NZFRI 26920)	musky storksbill
Euphorbia peplus	milkweed
Foeniculum vulgare	fennel
Fragaria vesca	wild strawberry

Fumaria bastardii (AK 287544)	Bastard's fumitory
Fumaria capreolata (NZFRI 27145)	rampant fumitory
Fumaria muralis	scrambling fumitory
Galium aparine	cleavers bedstraw
Galium divaricatum	slender bedstraw
Galium palustre	marsh bedstraw
Geranium molle	dovesfoot cranesbill
Geranium robertianum	herb Robert
Hedysarum coronarium (AK 219413)	sulla
Ipomoea indica	blue morning glory
Lagarosiphon major	lagarosiphon; oxygen weed
Lepidium africanum agg.	pepper cress
Lepidium bonariense	Argentine cress
Lepidium didymum	twin cress
Lepidium pseudotasmanicum	shade peppercresss
Lepidium virginicum	pepper grass
Linaria purpurea	purple linaria
Linum trigynum	yellow flax
Lotus pedunculatus	lotus
Lotus suaveolens (NZFRI 27356)	hairy birdsfoot trefoil
Ludwigia palustris	water purslane
Ludwigia peploides	primrose willow
Lythrum hyssopifolia	hyssop loosestrife
Malva neglecta	dwarf mallow
Malva nicaeensis (NZFRI 9547)	French mallow
Malva parviflora	small-flowered mallow
Marrubium vulgare	horehound
Medicago arabica	spotted bur medick
Medicago nigra	bur medick
Medicago sativa	lucerne
Melilotus indicus	King Island melilot
Mentha ×piperita	peppermint
Mentha pulegium	penny royal
Modiola caroliniana	creeping mallow
Myosotis arvensis	field forget-me-not
Myosotis laxa subsp. *caespitosa*	water forget-me-not
Myosotis sylvatica	garden forget-me-not
Myriophyllum aquaticum	parrot's feather
Nasturtium officinale	watercress
Oenothera stricta	evening primrose
Ornithopus perpusillus	wild seradella
Orobanche minor	broomrape
Oxalis articulata	sourgrass
Oxalis pes-caprae (NZFRI 26826)	Bermuda buttercup
Parentucellia viscosa	tarweed
Paronychia brasiliana	Brazilian whitlow
Pastinaca sativa	wild parsnip
Persicaria hydropiper	water pepper
Persicaria maculosa	willow weed
Persicaria prostrata	pink headed knot
Physalis peruviana	cape gooseberry
Phytolacca octandra	inkweed
Plantago australis	swamp plantain

Plantago coronopus	buck's-horn plantain
Plantago lanceolata	narrow-leaved plantain
Plantago major	broad-leaved plantain
Polycarpon tetraphyllum	allseed
Polygonum aviculare	wireweed
Portulaca oleracea	wild portulaca
Prunella vulgaris	selfheal
Ranunculus flammula	spearwort
Ranunculus repens	creeping buttercup
Ranunculus sceleratus	celery-leaved buttercup
Ranunculus trichophyllus (AK 104505)	water buttercup
Raphanus raphanistrum subsp. *maritimus* (NZFRI 26829)	sea radish
Reseda luteola (AK 271086)	wild mignonette
Rumex acetosella	sheep's sorrel
Rumex conglomeratus	clustered dock
Rumex obtusifolius	broad-leaved dock
Rumex pulcher (NZFRI 27351)	fiddle dock
Sagina procumbens	pearlwort
Sedum spectabile	showy sedum
Silene armeria (AK 219072)	sweet William, catchfly
Silene gallica	catchfly
Sisymbrium officinale	wild mustard, hedge mustard
Solanum chenopodioides	velvety nightshade
Solanum nigrum	black nightshade
Solanum tuberosum	potato
Spergula arvensis	spurrey
Stachys arvensis	staggerweed
Stellaria alsine (AK 270426)	bog stitchwort
Stellaria media	chickweed
Trifolium angustifolium (NZFRI 27346)	narrow-leaved clover
Trifolium arvense	haresfoot trefoil
Trifolium dubium	suckling clover
Trifolium glomeratum (WELT SP63270)	clustered clover
Trifolium pratense	red clover
Trifolium repens	white clover
Tropaeolum majus	garden nasturtium
Urtica urens (AK 270439)	nettle
Verbascum thapsus	woolly mullein
Verbena bonariensis	purple-top
Verbena brasilensis (NZFRI 23965)	Brazilian vervain
Veronica anagallis-aquatica	water speedwell
Veronica arvensis	field speedwell
Vicia hirsuta (NZFRI 27341)	hairy vetch
Vicia sativa	vetch

Appendix 3

Checklist of fauna species in Te Teko Ecological District

Information from Strickland 1993, Fauna Survey Unit unpublished; Department of Conservation 1993a; Beadel 1994b, Bull *et al.* 1985; Pickard and Towns 1988; Pierce 2001; Wildland Consultants 2002; Department of Conservation Biosite Database; Department of Conservation unpubl. records; K. Owen and A. Garrick pers. comm.; Gill 2010.

(i) Mammals

INDIGENOUS	
Chalinolobus tuberculata	pekapeka; long-tailed bat
INTRODUCED (FERAL)	
Cervus elaphus scoticus	red deer
Erinaceus europaeus	European hedgehog
Felis catus	cat
Lepus europaeus	brown hare
Mus musculus	kiore-iti; house mouse
Mustela erminea	stoat
Mustela nivalis vulgaris	weasel
Oryctolagus cuniculus	European rabbit
Rattus norvegicus	pouhawaiki; Norway rat
Rattus rattus	ship rat
Trichosurus vulpecula	brushtail possum

(ii) Birds[13] (in alphabetical order of scientific name)

INDIGENOUS	
Anas gracilis	tete; grey teal
Anas rhynchotis	kuruwhengi; Australasian shoveler
Anas superciliosa	parera; grey duck
Anthornis melanura melanura	korimako; makomako; bellbird
Anthus novaeseelandiae novaeseelandiae	pihoihoi; New Zealand pipit
Ardea ibis coromanda	eastern cattle egret
Ardea modesta	kotuku, white heron
Arenaria interpres	ruddy turnstone
Aythya novaeseelandiae	papango; New Zealand scaup
Botaurus poiciloptilus	matuku; Australasian bittern
Bowdleria punctata vealeae	matata; North Island fernbird
Calidrus acuminata	sharp-tailed sandpiper
Charadrius bicinctus bicinctus	tuturiwhatu; banded dotterel
Charadrius obscurus aquilonius	tuturiwhatu; northern New Zealand dotterel
Chlidonias albostriata	tarapiroe; black-fronted tern
Chlidonias leucopterus	white-winged black tern
Chrysococcyx lucidus lucidus	pipiwharauroa; shining cuckoo
Circus approximans	kahu; swamp harrier
Cygnus atratus	black swan

13 This list excludes vagrants.

Egretta garzetta immaculata	little egret
Egretta novaehollandiae novaehollandiae	white-faced heron
Egretta sacra sacra	matuku-moana; reef heron
Elseyornis melanops	black-fronted dotterel
Eudynamys taitensis	koekoea; long-tailed cuckoo;
Falco novaeseelandiae	New Zealand falcon
Fulica atra australis	Australian coot
Gallirallus philippensis assimilis	moho-pereru; banded rail
Gerygone igata	rironiro; grey warbler
Haematopus finschi	torea, South Island pied oystercatcher
Haematopus unicolor	torea, toreapango, variable oystercatcher
Hemiphaga novaeseelandiae	kererū; kukupa; New Zealand pigeon
Himantopus himantopus leucocephalus	poaka; pied stilt
Hirundo neoxena neoxena	welcome swallow
Hydroprogne caspia	taranui; Caspian tern
Larus bulleri	black-billed gull
Larus dominicanus dominicanus	karoro; southern black-backed gull
Larus novaehollandiae scopulinus	red-billed gull
Mohoua albicilla[14]	popokatea; whitehead
Morus serrator	Australasian gannet
Nestor meridionalis septentrionalis[15]	North Island kaka
Ninox novaeseelandiae novaeseelandiae	ruru; morepork
Phalacrocorax carbo novaehollandiae	kawau; black shag
Phalacrocorax melanoleucos brevirostris	kawaupaka; little shag
Phalacrocorax sulcirostris	little black shag
Phalacrocorax varius varius	karuhiruhi; pied shag
Platalea regia	kotuku-ngutupapa; royal spoonbill
Plegadis falcinellus	glossy ibis
Poliocephalus rufopectus	weweia; New Zealand dabchick
Porphyrio melanotus melanotus	pukeko
Porzana pusilla affinis	koitareke; marsh crake
Porzana tabuensis tabuensis	puweto; spotless crake;
Prosthemadera novaeseelandiae novaeseelandiae	tūī
Rhipidura fuliginosa placabilis	piwakawaka; North Island fantail
Stercorarius parasiticus	Arctic skua
Sterna striata	tara; white-fronted tern
Tadorna variegata	putangitangi; pari; paradise shelduck
Todiramphus sanctus vagans	New Zealand kingfisher
Vanellus miles novaehollandiae	spur-winged plover
Zosterops lateralis lateralis	silvereye; tauhou

INTRODUCED

Acridotheres tristis	common myna
Alauda arvensis	Eurasian skylark
Anas platyrhynchos platyrhynchos	mallard

14 Species likely to have occurred in Te Teko Ecological District in the past and which may still occur locally but whose presence has not been confirmed.

15 Not known to be resident in the ecological district.

Branta canadensis maxima	Canada goose
Callipepla californica brunnescens	California quail
Carduelis carduelis britannica	European goldfinch
Carduelis chloris	European greenfinch
Carduelis flammea	common redpoll
Columba livia	rock pigeon
Emberiza citrinella	yellowhammer
Fringilla coelebs	chaffinch
Gymnorhina tibicen	Australian magpie
Passer domesticus domesticus	house sparrow
Phasianus colchicus	common pheasant
Platycercus eximius	eastern rosella
Prunella modularis	dunnock
Sturnus vulgaris vulgaris	common starling
Synoicus ypsilophorus australis	Australian brown quail
Turdus merula merula	Eurasian blackbird
Turdus philomelos	song thrush

(iii) Frogs

INTRODUCED

Litoria raniformis	southern bell frog
Litoria aurea	green and golden bell frog

(iv) Fish (from Strickland 1993)

INDIGENOUS

Aldrichetta forsterii	yelloweyed mullet
Anguilla dieffenbachii	longfin eel
Anguilla australis	shortfin eel
Cheimarrichthys fosteri	torrentfish
Galaxias argenteus[16]	giant kōkopu
Galaxias brevipinnis	koaro
Galaxias fasciatus	banded kōkopu
Galaxias maculatus	inanga
Galaxias postvectis	shortjaw kōkopu
Geotria australis	lamprey
Gobiomorphus basalis	Crans bully
Gobiomorphus cotidianus	common bully
Gobiomorphus gobioides	giant bully
Gobiomorphus huttoni	redfin bully
Leptoscopus macropygus	stargazer
Mugil cephalus	grey mullet
Retropinna retropinna	common smelt
Rhombosolea leporina	yellowbelly flounder
Rhombosolea retiaria	black flounder

INTRODUCED

Carassius auratus	goldfish
Gambusia affinis	mosquitofish
Oncorhynchus mykiss	rainbow trout
Salmo trutta	brown trout
Salvelinus fontinalis	brook char

16 Unconfirmed record (based on one larval specimen; Strickland 1993).

Appendix 4

Conservation status of taxa in Te Teko Ecological District

WILDLIFE

Mammals (status from Hitchmough et al. 2007)

ACUTELY THREATENED

Nationally Vulnerable

Chalinolobus tuberculata	long-tailed bat

Birds (status from Miskelly et al. 2008)

THREATENED

Nationally Critical

Anas superciliosa	grey duck
Ardea modesta	white heron

Nationally Endangered

Botaurus poiciloptilus	Australasian bittern
Larus bulleri	black-billed gull

Nationally Vulnerable

Charadrius bicinctus bicinctus	banded dotterel
Charadrius obscurus aquilonius	northern New Zealand dotterel
Chlidonias albostriata	black-fronted tern
Egretta sacra sacra	reef heron
Falco novaeseelandiae[17]	New Zealand falcon
Hydroprogne caspia[17]	Caspian tern
Larus novaehollandiae scopulinus	red-billed gull
Nestor meridionalis septentrionalis[17]	North Island kākā
Phalacrocorax varius varius	pied shag
Poliocephalus rufopectus	New Zealand dabchick
Sterna striata	tara, white-fronted tern

AT RISK

Declining

Anthus novaeseelandiae novaeseelandiae	New Zealand pipit
Bowdleria punctata vealeae	North Island fernbird
Himantopus himantopus leucocephalus	pied stilt

Relict

Porzana pusilla affinis	marsh crake
Porzana tabuensis tabuensis	puweto, spotless crake

Naturally Uncommon

Eudynamys taitensis	long-tailed cuckoo
Gallirallus philippensis assimilis	banded rail
Phalacrocorax carbo novaehollandiae	black shag
Phalacrocorax sulcirostris	little black shag
Platalea regia	royal spoonbill

17 Not resident in district.

Recovering

Haematopus unicolor	variable oystercatcher

Fish (status from Hitchmough et al. 2007)

CHRONICALLY THREATENED

Gradual Decline

Anguilla dieffenbachia	longfin eel
Galaxias argenteus	giant kōkopu

AT RISK

Sparse

Galaxias postvectis	shortjaw kōkopu

PLANTS (status from de Lange *et al.* 2009 and Beadel 2009)

THREATENED

Nationally Endangered

Utricularia australis[18]

Nationally Vulnerable

Pimelea tomentosa

AT RISK

Declining

Austrofestuca littoralis[19]	
Coprosma acerosa s.s.	sand coprosma, tarakupenga
Cyclosorus interruptus	
Dianella haematica	
Thelypteris confluens	

Relict

Desmoschoenus spiralis	pīngao

Naturally Uncommon

Dicranopteris linearis	
Korthalsella salicornioides	
Kunzea ericoides var. *microflora*	prostrate kānuka
Tetragonia tetragonioides	kōkihi

TAXONOMICALLY INDETERMINATE

Threatened-Nationally Vulnerable

Kunzea aff. *ericoides* (d)	Thornton kānuka

At Risk-Naturally Uncommon

Pterostylis aff. *graminea*

Non-Resident Native-Coloniser

Sicyos aff. *australis* (b)	mawhai

REGIONALLY UNCOMMON

Bolboschoenus caldwellii
Carex aff. *raoulii* ("raotest")
Empodisma minus

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18 Not recorded in Te Teko Ecological District since 1960s.
19 Not recorded in Te Teko Ecological District since 1949.

Epilobium chionanthum	
Hypolepis distans	
Melicytus novae-zelandiae	coastal māhoe
Oxalis rubens	
Parietaria debilis	
Pterostylis aff. *montana* agg.	
Ruppia sp.	
Sparganium subglobosum	maru, burr reed
Suaeda novae-zelandiae	
Tetraria capillaris	
Wolffia australiana	

Appendix 5

Areas and percentages of current vegetation in the Te Teko Ecological District

VEGETATION AND HABITAT TYPE	LANDFORM UNITS														
	ALLUVIAL PLAIN			WETLAND			LOW SAND RISES			SAND DUNES			OCEANIC BEACHES		
	AREA (ha)	% of LF	% of ED	AREA (ha)	% of LF	% of ED	AREA (ha)	% of LF	% of ED	AREA (ha)	% of LF	% of ED	AREA (ha)	% of LF	% of ED
Modified primary forest	1.56	0.01	0.00												
Secondary forest	11.01	0.04	0.03												
Secondary scrub and shrubland	27.75	0.10	0.09												
Willow canopy	3.53	0.01	0.01	226.46	38.84	0.71	0.38	0.04	0.00						
Mixed willow and indigenous canopy	1.49	0.01	0.00	111.42	19.11	0.35				5.37	0.27	0.02			
Indigenous canopy	6.22	0.02	0.02	103.55	17.76	0.33				1.59	0.08	0.01			
Willow canopy and willow/privet forest and scrub				66.70	11.44	0.21									
Thermal vegetation	0.28	0.00	0.00												
Lake															
Ponds/lake	0.25	0.00	0.00	2.59	0.44	0.01				2.97	0.15	0.01			
Geothermal pond															
River	9.47	0.03	0.03												
Exotic habitat	27,311.09	99.73	86.03	41.37	7.10	0.13	1,063.29	99.95	3.35	1,528.85	75.98	4.82			
Treeland	1.57	0.01	0.00												
Intertidal flat (unvegetated)	0.06	0.00	0.00												
Estuarine channel	2.54	0.01	0.01	0.38	0.07	0.00	0.17	0.02	0.00	0.30	0.02	0.00	0.22	0.23	0.00
Estuarine saltmarsh	7.10	0.03	0.02	22.93	3.93	0.07				2.31	0.11	0.01			
Predominantly indigenous species - spinifex, pōhuehue; local exotics	0.01	0.00	0.00	7.62	1.31	0.02				255.55	12.70	0.81	0.01	0.01	0.00
Mixture of indigenous and exotic species in roughly equal proportions—boxthorn and pōhuehue										95.79	4.76	0.30			
Predominantly exotic species - indigenous species locally common										119.47	5.94	0.38			
Beach sand										0.03	0.00	0.00	93.67	99.76	0.30
Grand Total	**27,383.91**	**100.00**	**86.26**	**583.03**	**100.00**	**1.84**	**1,063.84**	**100.00**	**3.35**	**2,012.24**	**100.00**	**6.34**	**93.90**	**100.00**	**0.30**

VEGETATION AND HABITAT TYPE	LANDFORM UNITS												TOTAL	
	LAKES/PONDS			INTERTIDAL FLATS			ESTUARINE CHANNELS			RIVERS				
	AREA (ha)	% of LF	% of ED	AREA (ha)	% of LF	% of ED	AREA (ha)	% of LF	% of ED	AREA (ha)	% of LF	% of ED	AREA (ha)	% of ED
Modified primary forest													1.56	0.00
Secondary forest													11.01	0.03
Secondary scrub and shrubland													27.75	0.09
Willow canopy	0.93	0.59	0.00										231.30	0.73
Mixed willow and indigenous canopy	0.00	0.00	0.00										118.29	0.37
Indigenous canopy	4.80	3.02	0.02							0.78	0.26	0.00	116.93	0.37
Willow canopy and willow/privet forest and scrub													66.70	0.21
Thermal vegetation													0.28	0.00
Lake	31.91	20.12	0.10										31.91	0.10
Ponds/lake	78.67	49.61	0.25										84.48	0.27
Geothermal pond	0.28	0.18	0.00										0.28	0.00
River										301.88	99.74	0.95	311.35	0.98
Exotic habitat	23.41	14.76	0.07	1.30	3.61	0.00	3.78	3.42	0.01				29,973.10	94.42
Treeland													1.57	0.00
Intertidal flat (unvegetated)				16.17	45.11	0.05	0.42	0.38	0.00				16.65	0.05
Estuarine channel							104.89	94.84	0.33				108.50	0.34
Estuarine saltmarsh				18.39	51.28	0.06	1.50	1.36	0.00				52.22	0.16
Predominantly indigenous species - spinifex, pōhuehue; local exotics	18.57	11.71	0.06										281.77	0.89
Mixture of indigenous and exotic species in roughly equal proportions—boxthorn and pōhuehue													95.79	0.30
Predominantly exotic species - indigenous species locally common													119.47	0.38
Beach sand													93.71	0.30
Grand Total	**158.57**	**100.00**	**0.50**	**35.85**	**100.00**	**0.11**	**110.59**	**100.00**	**0.35**	**302.66**	**100.00**	**0.95**	**31,744.61**	**100.00**

Appendix 6

Wild sites in Te Teko Ecological District

(These sites were assessed but did not qualify as RAPs.)

W1 *Waioho Stream Tributary* (*NZMS260 W15 586504*)

Crack willow/privet forest. Understorey is dominated by naturalised species including tradescantia, montbretia (*Crocosmia ×crocosmiiflora*), Japanese honeysuckle, and wild ginger (*Hedychium gardnerianum*). A few examples of indigenous species were observed, including tī kōuka, karamū, and *Doodia australis*.

W2 *Rangitaiki River Margins* (*NZMS260 V15 455477 - V15 443400*)

Crack willow generally forms the canopy on these sites. The understorey is dominated by naturalised species.

W3 *Park Road* (*NZMS260 V15 407423*)

Very small area, grazed, dominated by blackberry and naturalised grasses and herbs.

W4 *Lake Onerahi Extension* (*NZMS260 V15 409414*)

This area is contiguous with Lake Onerahi, however its vegetation cover comprises predominantly naturalised species and is grazed. (Grey willow/blackberry scrub and *Baumea articulata*/blackberry shrubland with exotic herbs and grasses common.)

W5 *Tarawera River Bend* (*NZMS260 V15 367432*)

A degraded and heavily grazed area of predominantly exotic trees and weed species with a small area of kānuka forest. A narrow wet gully, draining into the Tarawera, bisects the area where scattered *Juncus effusus* and pasture grasses occur.

W6 *Tarawera River* (*NZMS260 V15 408545*)

A narrow strip of wetland vegetation heavily modified by both grazing and the establishment of crack willow following disturbance.

W7 *Tarawera Road* (*NZMS260 V15 377406*)

One small pond surrounded by pasture.

W8 *Whakatane River Oxbow B* (*NZMS260 W15 593507*)

Grazed to margins. Reed sweetgrass locally common with crack willow scattered along margins. Fauna present includes harrier hawk, pukeko and mallard ducks. Dabchick may be present.

W9 *Tītoki B* (*NZMS260 W15 589487*)

Scattered tītoki with occasional kahikatea and pukatea trees on Rangitaiki Plains adjacent to Titoki Rd.

W10 *Mason Road Kahikatea* (*NZMS260 W15 592495*)

Scattered kahikatea with occasional tītoki, tī kōuka and pukatea scattered over an area of about 1 ha. Cattle damage to tree trunks. Grazed around margins.

W11 *Mason Road Treeland* (*NZMS260 W15 585496*)

Crack willow treeland along stream margins with occasional tī kōuka and karamū. Mallard ducks present.

W12 *Waioho Stream Treeland* (*NZMS260 W15 564475*)

Crack willow treeland with infrequent twisted willow, pukatea, kahikatea, kānuka and tītoki. Blackberry is common in the understorey with occasional inkweed.

W13 *Thompson Road Remnant* (*NZMS260 V15 381447*)

Scattered (kānuka)/broom-privet-blackberry shrubland.

W14 *Sullivan Lake* (*NZMS260 W15 603514*)

Lake is surrounded by mown exotic grasses and herbs. Aquatic plants include *Azolla rubra* and water lilly. Harakeke occurs on the lake margins. The small island at the eastern end of the lagoon has been planted in alders. Harakeke, karamū, *Coprosma propinqua* and mamaku also occur on the island. Birds observed at the site were Australian coot, dabchick, pukeko, and mallard ducks.

W15 *Awatapu Lagoon* (*NZMS260 W15 590521*)

Lagoon is surrounded by crack willow and exotic grasses and herbs. Water surfaces largely covered with *Azolla filiculoides, Spirodela punctata,* and parrot's feather. Indigenous and exotic trees and shrubs have been established around the lagoon margins. There are a few small areas of raupō reedland, but generally exotic grasses and herbs extend down to the lagoon edge. Two dabchicks, Australian coots, and mallard ducks were noted at the site.

W17 *Rangitaiki River Oxbow* (*Tahuna Road*) (*NZMS260 V15 434434 and V15 434437*)

Grey willow forest. When visited in 1995 these areas were under water. Understorey was very sparse. Domestic rubbish has been dumped along the margins and debris (including plastic bottles and timber off cuts) occurs throughout the southern oxbow.

W18 *Rangitaiki River Oxbow* (*Tahuna Road*) (*NZMS260 V15 440410*)

Grey willow/blackberry shrubland is the major vegetation type. There is a small area of *Bolboschoenus fluviatilis* and reed sweetgrass. Other weeds are common including pampas and gorse.

W19 *Tarawera Road Pond* (*NZMS260 V15 379406*)

Pasture to water's edge. Small area of giant spike sedge reedland on south-eastern side. There are several small ponds in this vicinity. One is a RAP (Tarawera Road RAP); the remainder are small and surrounded by pasture.

W20 *Waioho Stream Tributary B* (*NZMS260 W15 587498*)

Crack willow forest. Dominated by naturalised species.

W21 *Smith Road* (*NZMS260 V15 476583*)

This site is part of the old Rangitaiki River bed (which has been incorporated in the Rangitaiki Plains drainage system). Relatively extensive areas of raupō reedland with local *Juncus effusus* and *Carex secta* occur along canal margins with infrequent tī kōuka; grazed throughout.

W22 *Thompson Road* (*NZMS260 V15 384449*)

A small degraded wetland which is now partially drained. Scattered crack willow over pasture grasses and weeds. Grazed throughout and heavily infested by weed species.

W23 *Onepu Road* (*NZMS260 V15 381445*)

Juncus effusus rushland in low lying padock.

W24 *Tarawera River Willow Forest* (*NZMS260 V15 391505*)

Willow canopy and willow/privet forest and scrub alongside the Tarawera River contiguous with the Young Wetland RAP.

W25 *Reids Central Canal Island* (*NZMS260 W15 503559*)

Tī kōuka-dead grey willow/raupō reedland; Tī kōuka-dead grey willow/reed sweetgrass treeland. (The grey willow appeared to be dead at the time of inspecting, this may be the result of salt water inundation.) This site comprises a small island of wetland vegetation at the intersection of Reids Central Canal and Kopeopeo Canal which probably developed following construction of the canal crossing. It is dominated by naturalised species, with the exception of some local kānuka about 4 m tall.

W27 *Mangaone Stream Willow Forest* (*NZMS260 V15 384487*)

Grey willow forest. Grey willow generally forms the canopy with privet locally dominant and local scattered privet common in the understorey. Ferns locally common, including *Deparia petersenii* and whekī. Creeping buttercup is common. A few examples of *Baumea tenax*, *Carex* sp. (*C. geminata* agg.) and *Carex secta* were recorded. This site has been drained and was grazed at the time of inspection (September 1995). This site is dominated by naturalised species, however it is a relatively large area of low-lying land that has been drained and subsequently dried out, allowing naturalised species to dominate the site. This site is contiguous with one of the small wetlands in RAP 11. (12 ha)

Appendix 7

Minor units of crown land administered by the Department of Conservation within the Te Teko Ecological District

(excludes Crown land described within sites in the text of this report)

SITE NO.	CODE CLASSIFICATION	SIZE (ha)	LAND STATUS	CENTRAL GRID REF.	DESCRIPTION
W15028	CAST 62	5.0844	Stewardship Area	NZMS260 W15 599503	An area of pasture on the true left of Whakatane River margin. Stopbanked by Environment BOP. Poroporo. Site known as Pahou Stewardship Area.
W15030	CAST 62	5.3980	Stewardship Area	NZMS260 W15 586513	Grazed pasture at the junction of the Whakatane and Waioho Rivers.
W15031	CAST 62	5.2710	Stewardship Area	NZMS260 W15 575523	Area of pasture at the intersection of the Te Rahu canal and Whakatane River. Grazed pasture with willow along the river margin. Stopbanked by Environment BOP.
V15047	CAST 62	1.2320	Stewardship Area	NZMS260 V15 485557	Grazed pasture on the margin of the Rangitaiki River.
V15056	RARR	3.8897	Recreation Reserve	NZMS260 V15 358407	Kānuka treeland and poplar/willow forest on both sides of the Tarawera River adjacent to Fletcher Avenue, Kawerau. Degraded by woody weeds. The area is currently being restored (control of weeds and planting as required).
V15058	CAST 62	1.2899	Stewardship Area	NZMS260 V15 467527	Grazed pasture on the riparian margin of Rangitaiki River, north of Edgecumbe Township - stopbank administered by Environment BOP.
V15068	CAST 62	0.1977	Stewardshp Area	NZMS260 V15 467507	Grazed pasture on the true right of the Rangitaiki River, south of Edgecumbe township. Crack willow along water margin and large weeping willow.
V15088	CAST 62	3.0000	Stewardship Area	NZMS260 V15 462503	Grazed pasture on the margins of the Rangitaiki River.
V15108	CAMS 24	3.2563	Marginal Strip	NZMS260 V15 386495	Marginal strip along true left of Tarawera River in Otakiri area. Grazed pasture with scattered areas of grey willow and privet forest and shrubland.
V15109	CAMS 24	6.0764	Marginal Strip	NZMS260 V15 388526	Marginal strip along the Tarawera River margin. Mostly grazed pasture with crack willow, brush wattle, and tree lucerne in places. Small area of raupō reedland.
V15110	CAMS 24	10.3697	Marginal Strip	NZMS260 V15 377449	Marginal strip on both sides of Tarawera River extending from Norske Skog treatment ponds to SH30. Mostly woody weeds, including Pinus radiata, poplar and willows, but with areas of indigenous vegetation. Informally grazed throughout, excluding a section of the river's true right where it passes through Norske Skog's treatment ponds.
V15111	CAMS 24	4.4728	Marginal Strip	NZMS260 V15 412554	Section of Tarawera River margin, Environment BOP stopbank. Grazed pasture, reed sweetgrass along water margin with occasional willow, blackberry, and gorse.
V15112	CAMS 24	11.4851	Marginal Strip	NZMS260 V15 425587	Grazed pasture along the Tarawera River margin, between SH2 and Kohika wetland.
V15113	CAMS 24	8.6000	Marginal Strip	NZMS260 V15 445585	Marginal strip along the Awaiti Stream (now canal). Grazed pasture with occasional willow and blackberry.

SITE NO.	CODE CLASSIFICATION	SIZE (ha)	LAND STATUS	CENTRAL GRID REF.	DESCRIPTION
V15115	CAMS 24	11.9153	Marginal Strip	NZMS260 V15 474538	Marginal strip along the Rangitaiki River extending from c. 0.5 km south of Edgecumbe township for c. 3.5 km. Stopbanked by Environment BOP and grazed by the adjoining landowners.
V15117	CAMS 24	4.9468	Marginal Strip	NZMS260 V15 384485	Marginal strip along the Tarawera River margin.
V15118	CAMS 24	3.7931	Marginal Strip	NZMS260 V15 464588	Part of the old Rangitaiki River bed, now used as a drainage canal. Much of the area is grazed, but intermittent areas of indigenous vegetation, including a small area of planted kānuka are present.
V15121	CAST 7	0.2256	Conservation Area (part)15	NZMS260 V15 433605	Gravel dump (part).

Whakatane District Council vested reserves and esplanade strips in the Te Teko Ecological District

SITE	LEGAL STATUS	AREA (ha)	DESCRIPTION
Mangaone Stream	Esplanade strip	0.6500	5 m wide esplanade strip (Lot 3) on both sides of the Mangaone Stream

Classification Codes

Lands Vested in the Crown and Administered by the Department (excluding reserves where other agencies appointed to control and manage)

CAST 7 Stewardship Area, Section 7 Conservation Act 1987 (land acquired and held for conservation purposes since the enactment of the Conservation Act 1987)
CAST 62 Stewardship Area, Section 62, Conservation Act 1987
CAMS 24 Marginal Strip, Section 24, Conservation Act 1987
RARR Recreation Reserve, Reserves Act 1977

Appendix 8

TE TEKO ECOLOGICAL DISTRICT PNAP SURVEY FORM

STUDY AREA NAME | PNAP SURVEY NO.

RECORDER | DATE | PREDOM. ASPECTS

NZMS 260 | GRID REF. | AERIAL PHOTO

LAND TYPE | BIOC. ZONE | ALTITUDE RANGE

OWNERSHIP (Address/Phone)	LANDOWNER'S ATTITUDE/COMMENTS

Vegetation Dynamics ☐ Primary ☐ Secondary ☐ Modified ☐ Don't Know ☐ Predominantly exotic

	H	M	L	Don't Know	Notes
Representativeness					
Diversity and pattern					
Naturalness					
Size and shape					
Rarity and special features					
Buffering and connectivity					
Viability					

Threats	**Current[1] (NLMH)**	**Future[2] (NLMH)**	**Comments**
Grazing			Is it grazed? By what?
Weeds			
Wild Animals			
Drainage			
Erosion			
Fire			
Clearance			
Topdressing			
Other			
Requirements			
Fencing		Is it fenced?	
Protection			

BIRDS	OTHER FAUNA

1. Degree of Impact; 2. Likelihood of Occurring

ECOLOGICAL UNITS WITHIN THE NATURAL AREA

Vegetation Type	% Cover	Canopy Height	Landform

ECOL. PATTERN	FLORA

NOTES: Notes (record impression of site), references. Other values: (Landscape, cultural, recreational, educational, economic, historical, spiritual etc) (LMH) (also consider potential damage).

WEEDS

TE TEKO ECOLOGICAL DISTRICT ECOLOGICAL ASSESSMENT FORM

Site #: Area: Assessment date:
Site name: Assessment personnel:

Character	% cover1
Indigenous	
Exotic	
N/A (specify)	

Dynamics	% cover[1]
Primary	
Modified primary	
Secondary	
N/A	

Landscape diversity	Number
Bioclimatic zones (specify)	
Landforms	
Vegetation units	

EVALUATION CRITERIA

Representativeness: The primary criterion, based on a comparison of present vegetation cover vs past extent, diversity and pattern, naturalness, and size.

H Best, relatively large, good quality example; only example of type which was formerly more extensive
M Similar to other areas that occur elsewhere in the ecological district
L Degraded, small, better quality examples exist elsewhere in the ecological district.

Diversity and pattern: The diversity of ecological and physical features, and the patterns that exist within an area under consideration.

H More than two landforms or bio-climatic zones; or more than 7 vegetation classes
M More than one landform or bio-climatic zone; or 4-7 vegetation classes
L Only one landform and bio-climatic zone; or 1-3 vegetation classes

Naturalness: The degree to which the vegetation and habitats reflect likely natural character. Most mainland ecosystems are modified but the degree of naturalness is an important consideration.

H Low-level or nil human disturbance (includes secondary vegetation established following natural disturbance)
M Moderate level of human disturbance (for example relatively good quality secondary vegetation developed following human disturbance, low levels of selective logging 20 or more years earlier)
L Exotic/induced/heavily logged

Size and shape: Areas which are relatively large (i.e. compared to the mean size of remaining areas of indigenous vegetation in an Ecological District) are preferred to small areas. Small areas can be affected strongly by edge effects. A compact single area is generally preferable to long narrow areas or small separate remnants.

H Primarily compact, no major constrictions; or large size
M Irregular or convoluted; or moderate size
L Highly convoluted or discontinuous; or small size

Rarity and special features: The relative rarity of physical landscape features, vegetation, habitats and species within an ecological region or district or on a national basis (see Hitchmough 2007).

H Nationally threatened species present (includes nationally critical, endangered, vulnerable, and serious decline).
M Nationally or regionally uncommon species present; nationally or regionally uncommon vegetation classes or types present (includes gradual decline, range restricted, sparse).
L No threatened or uncommon species present.

Buffering and connectivity: The degree to which a natural area is protected or buffered by the surrounding landscape, or provides a buffer to other areas. A site may play an important role by connecting other areas of indigenous vegetation or habitat, or providing a riparian buffer.

H Part of a continuous natural landscape
M Part of a semi-continuous natural landscape/one of many discrete natural areas - some linkages
L Very isolated from other areas

Viability: The likelihood of an area remaining ecologically viable over time. Larger areas are generally more likely to remain viable with lower levels of management input.

H Large areas that will require relatively little active management to remain viable.
M Areas that will require some active management.
L Small or vulnerable ecosystem types, or high degree of active management required.

[1] Estimate land cover to nearest 10%.

IMPORTANT FEATURES

Existing classification

RAP	
SSWI rank	
Other	

Known notable features

Distribution limits	
Nationally rare veg. types	
Taxa endemic to ED	
Features rare in district (incl. only known site for taxa in ED)	
Other	

Flora and fauna

New Zealand Threat Classification System lists (Townsend *et al*. 2008)		
Category	# of species	Species
New Zealand Threat Classification System lists (Molloy *et al*. 2002)		
Category	# of species	Species

Appendix 9

Categories of threat

In this report the categories of threat follow the New Zealand Threat Classification developed by Townsend *et al.* (2008) for plants and avifauna, and Molloy *et al.* (2002) for other fauna. Definitions of these categories are provided below, as follows:

- Figure 1 from Townsend *et al.* 2008 showing the structure of the 2007 and 2002 New Zealand Threat Classification System.
- Section 8 from Townsend *et al.* 2008 to explain the new species classification systems.
- Sections 3 and 7 from Molloy *et al.* (2002).

From Townsend et al. 2008, p. 11

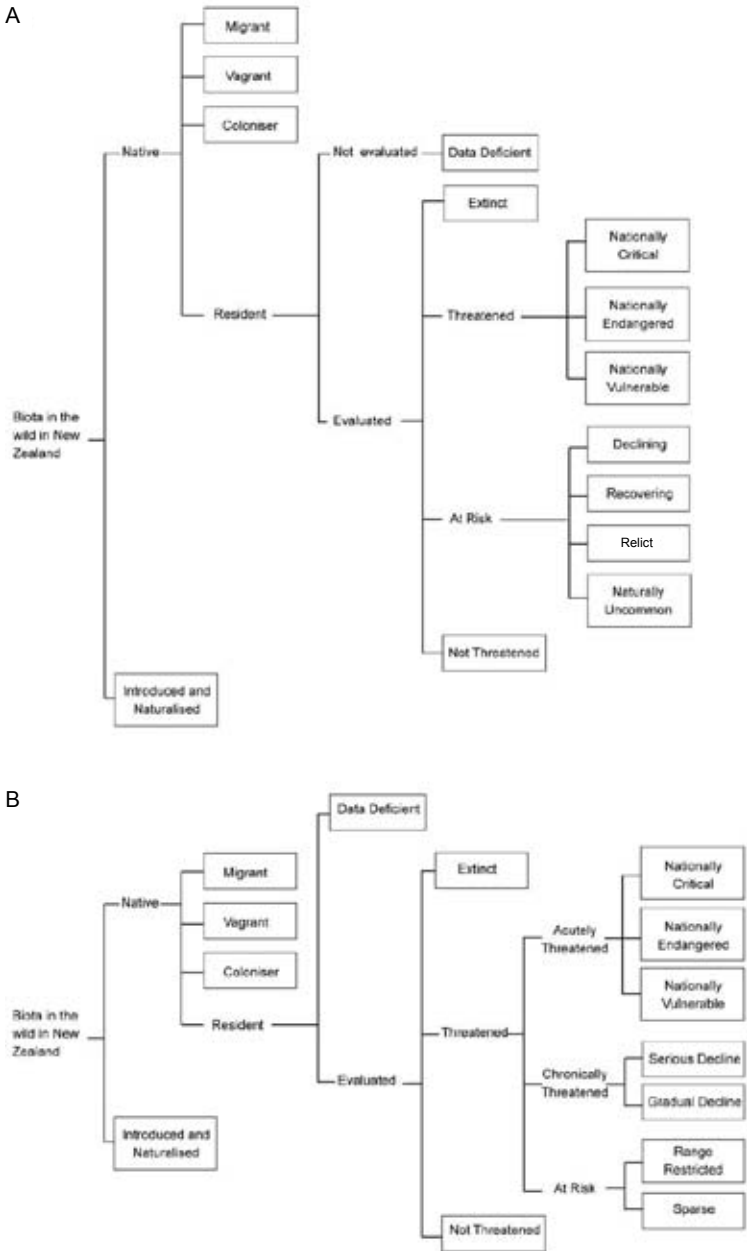

Figure 1. A. Revised (2007) and B. original (2002) structure of the New Zealand Threat Classification System.

From Townsend *et al.* 2008, pp. 18–21

8. Criteria for 'Threatened' taxa

'Threatened' taxa are grouped into three categories: 'Nationally Critical', 'Nationally Endangered' and 'Nationally Vulnerable'.

Taxa with populations that are small (< 250 mature individuals) are considered highly susceptible to stochastic events and so are listed as 'Nationally Critical', regardless of whether their small population size is due to human-induced or natural causes[6].

NATIONALLY CRITICAL

A. Very small population (natural or unnatural)

A taxon is 'Nationally Critical', regardless of population trend and regardless of whether the population size is natural or unnatural, when evidence[7] indicates that:

1. There are fewer than 250 mature individuals; or
2. There are ≤ 2 sub-populations *and* ≤ 200 mature individuals in the largest sub-population; or
3. The total area of occupancy is ≤ 1 ha (0.01 km^2).

B. Small population (natural or unnatural) with a high ongoing or predicted decline

A taxon is 'Nationally Critical' when evidence indicates that it fits at least one Status criterion *and* the Trend criterion as follows:

Status

1. The population comprises 250–1000 mature individuals; or
2. There are ≤ 5 sub-populations *and* ≤ 300 mature individuals in the largest sub-population; or
3. The total area of occupancy is ≤ 10 ha (0.1 km^2).

Trend

There is an ongoing or predicted decline of 50–70% in the total population due to existing threats, taken over the next 10 years or three generations, whichever is longer.

C. Population (irrespective of size or number of sub-populations) with a very high ongoing or predicted decline (> 70%)

A taxon is 'Nationally Critical' when the population has an ongoing trend or predicted decline of > 70% in the total population due to existing threats taken over the next 10 years or three generations, whichever is longer.

---

6 See definition of 'Natural' in Appendix 1.

7 Evidence in this context is defined as quantitative data and supporting information about the status of a candidate taxon.

NATIONALLY ENDANGERED

A. Small population (natural or unnatural) that has a low to high ongoing or predicted decline

A taxon is 'Nationally Endangered' when evidence indicates that it fits at least one Status criterion *and* the Trend criterion as follows:

Status

1. The total population size is 250–1000 mature individuals; or
2. There are ≤ 5 sub-populations *and* ≤ 300 mature individuals in the largest sub-population; or
3. The total area of occupancy is ≤ 10 ha (0.1 km^2).

Trend

There is an ongoing or predicted decline of 10–50% in the total population due to existing threats, taken over the next 10 years or three generations, whichever is longer.

B. Small stable population (unnatural)

To trigger this pathway to 'Nationally Endangered', taxa must have current population sizes that result from unnatural causes. Such taxa are defined as 'Nationally Endangered' when evidence indicates that they fit at least one Status criterion *and* the Trend criterion as follows:

Status

1. The total population size is 250–1000 mature individuals; or
2. There are ≤ 5 sub-populations *and* ≤ 300 mature individuals in the largest sub-population; or
3. The total area of occupancy is ≤ 10 ha (0.1 km^2).

Trend

The population is stable (± 10%) and is predicted to remain stable over the next 10 years or three generations, whichever is longer.

C. Moderate population and high ongoing or predicted decline

A taxon is 'Nationally Endangered' when evidence indicates that it fits at least one Status criterion *and* the Trend criterion as follows:

Status

1. The total population size is 1000–5000 mature individuals; or
2. There are ≤ 15 sub-populations *and* ≤ 500 mature individuals in the largest sub-population; or
3. The total area of occupancy is ≤ 100 ha (1 km^2).

Trend

There is an ongoing or predicted decline of 50–70% in the total population due to existing threats, taken over the next 10 years or three generations, whichever is longer.

A. Small, increasing population (unnatural)

To trigger 'Nationally Vulnerable', taxa must have current population sizes that result from unnatural causes. Such taxa are defined as 'Nationally Vulnerable' when evidence indicates that they fit at least one Status criterion *and* the Trend criterion as follows:

Status

1. The total population size is 250–1000 mature individuals; or
2. There are ≤ 5 sub-populations *and* ≤ 300 mature individuals in the largest sub-population; or
3. The total area of occupancy is ≤ 10 ha (0.1 km^2).

Trend

The population is increasing (> 10%) and is predicted to continue to increase over the next 10 years or three generations, whichever is longer.

B. Moderate, stable population (unnatural)

To trigger 'Nationally Vulnerable', taxa must have current population sizes that result from unnatural causes. Such taxa are defined as 'Nationally Vulnerable' when evidence indicates that they fit at least one Status criterion *and* the Trend criterion as follows:

Status

1. The total population size is 1000–5000 mature individuals; or
2. There are ≤ 15 sub-populations *and* ≤ 500 mature individuals in the largest sub-population; or
3. The total area of occupancy is ≤ 100 ha (1 km^2).

Trend

The population is stable (± 10%) and is predicted to remain stable over the next 10 years or three generations, whichever is longer.

C. Moderate population, with population trend that is declining

A taxon is 'Nationally Vulnerable' when evidence indicates that it fits at least one Status criterion *and* the Trend criterion as follows:

Status

1. The total population size is 1000–5000 mature individuals; or
2. There are ≤ 15 sub-populations *and* ≤ 500 mature individuals in the largest sub-population; or
3. The total area of occupancy is ≤ 100 ha (1 km^2).

Trend

There is an ongoing or predicted decline of 10–50% in the total population due to existing threats, taken over the next 10 years or three generations, whichever is longer.

D. Moderate to large population and moderate to high ongoing or predicted decline

A taxon is 'Nationally Vulnerable' when evidence indicates that it fits at least one Status criterion *and* the Trend criteria as follows:

Status

1. The total population size is 5000–20 000 mature individuals; or
2. There are ≤ 15 sub-populations *and* ≤ 1000 mature individuals in the largest sub-population; or
3. The total area of occupancy is ≤ 1000 ha (10 km^2).

Trend

There is an ongoing or predicted decline of 30–70% in the total population due to existing threats, taken over the next 10 years or three generations, whichever is longer.

E. Large population and high ongoing or predicted decline

A taxon is 'Nationally Vulnerable' when evidence indicates that it fits at least one Status criterion *and* the Trend criterion as follows:

Status

1. The total population size is 20 000–100 000 mature individuals; or
2. The total area of occupancy is ≤ 10 000 ha (100 km^2).

Trend

There is an ongoing or predicted decline of 50–70% in the total population or area of occupancy due to existing threats, taken over the next 10 years or three generations, whichever is longer.

From Molloy *et al.* 2002, pp. 11–14

3. Classification structure and categories

The specifications that workshop participants identified as being essential for the classification system were used to guide development of the classification structure and the categories. This section describes each of the categories (shown in Fig. 1).

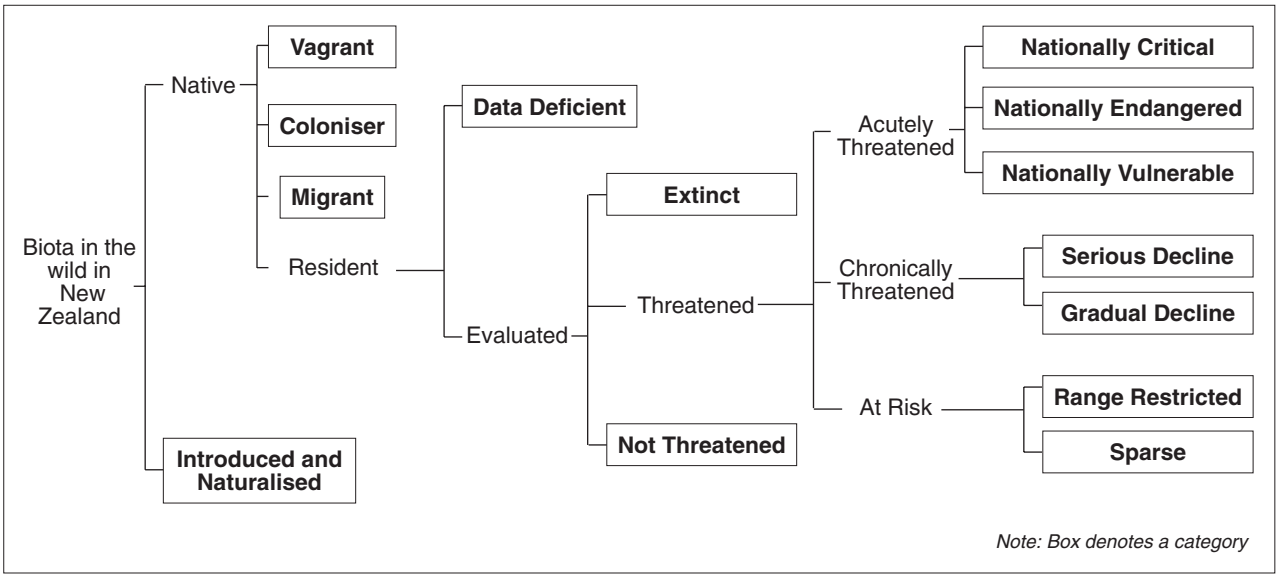

FIGURE 1. STRUCTURE OF THE NEW ZEALAND THREAT CLASSIFICATION SYSTEM.

INTRODUCED AND NATURALISED

Introduced and Naturalised taxa are those that have become naturalised in the wild after being deliberately or accidentally introduced to New Zealand by human agency.

If an Introduced and Naturalised taxon has an IUCN Red Listing in its country (or countries) of origin, the IUCN category and source of the listing are shown after the taxon's name in the New Zealand list. Current examples of this include the cress *Lepidium hyssopifolium* and the southern bell frog (*Litoria raniformis),* both of which are listed as Endangered in Australia; and the Parma wallaby (*Macropus parma*), listed as Lower risk/Near threatened.

VAGRANT

For the purposes of this document, vagrants are taxa that are found unexpectedly and rarely in New Zealand, and whose presence in our region is naturally transitory. These are taxa that do not establish themselves beyond their point of arrival because of reproductive failure or for specific ecological reasons (see de Lange & Norton 1998).

Examples include the red-kneed dotterel (*Erythrogonys cinctus)* and the blue moon butterfly (*Hypolimnas bolina nerina),* both from Australia*,* and the spotted sawtail (*Prionurus maculatus*) from the tropical south-west Pacific Ocean.

If a taxon in the Vagrant category has been listed in an IUCN Red List in its country of origin, the IUCN category and source of the listing are shown beside the taxon's name in the New Zealand list.

COLONISER

Colonisers are taxa that have arrived in New Zealand without direct or indirect help from humans and have been successfully reproducing in the wild for less than 50 years. Three examples are the Nankeen night heron (*Nycticorax caledonicus*), the scoliid wasp *Radumeris tasmaniensis* and the orchid *Cryptostylis subulata.*

The IUCN Red List category and source of the listing is included where this exists.

MIGRANT

Taxa that predictably and cyclically visit New Zealand as part of their normal life cycle, but do not breed here are included in the category Migrant. Examples include the Arctic skua (*Stercorarius parasiticus*) and striped marlin (*Tetrapturus audax*).

In contrast, taxa that either breed here and migrate beyond New Zealand during their life cycle, e.g. Chatham Island albatross (*Thalassarche eremita*), or taxa that are resident in New Zealand for most of their lives, such as longfinned eels (*Anguilla dieffenbachii*), are not included in this category.

The IUCN Red List category and source of the listing is included where this exists.

DATA DEFICIENT

The amount of information available for assessing the threat of extinction is highly variable between taxa and groups of taxa. At one extreme there are taxa such as kakapo, *Gunnera hamiltonii* and *Tecomanthe speciosa* where every wild individual is known, while at the other extreme there are taxa whose ecology and biology is virtually unknown (e.g. *Koeleria riguorum*, a recently described grass).

Certain criteria and/or definitions must be met for a taxon to be listed in a category. Where information is so lacking that an assessment is not possible, the taxon is assigned to the Data Deficient category. If a taxon is listed in a category other than Data Deficient but confidence in the listing is low due to poor quality data, then the listing can be qualified with the letters DP (Data Poor) to indicate this (see Section 6, item 5: p. 17).

EXTINCT

A taxon is listed as Extinct when there is no reasonable doubt, after repeated surveys in known or expected habitats at appropriate times (diurnal, seasonal and annual) and throughout the taxon's historic range, that the last individual has died. Examples include huia (*Heteralocha acutirostris*) and Adams's mistletoe (*Trilepidea adamsii*). Only taxa that have become extinct since 1840 are included in the list. Taxa that are extinct in the wild but occur in captivity or cultivation are not listed in this category. These are listed as Critically Endangered and are qualified with the letters EW (Extinct in the Wild—see Section 4, p. 15).

THREATENED

The threatened categories are grouped into three major divisions: 'Acutely Threatened', 'Chronically Threatened' and 'At Risk'.

Acutely Threatened

The categories in the 'Acutely Threatened' division—Nationally Critical, Nationally Endangered and Nationally Vulnerable—equate with the IUCN categories of Critically Endangered, Endangered and Vulnerable. Taxa in these three categories are facing a very high risk of extinction in the wild, as defined by criteria that quantify:

- Total population size
- Area of occupancy
- Fragmentation of populations
- Declines in total population
- Declines in habitat area
- Predicted declines due to existing threats

Although the criteria (described in Section 6) measure similar population features as those in the IUCN Red List criteria, numerical limits and timeframes are tailored to suit New Zealand circumstances. These were set through a process of testing and refinement by the project team and as a result of feedback from New Zealand species experts. Criteria that attempt to predict declines due to possible future threats are not included because of the highly speculative nature of this type of assessment.

Chronically Threatened

Taxa listed in either of the two categories in the 'Chronically Threatened' grouping (Serious Decline and Gradual Decline) also face extinction, but are buffered slightly by either a large total population, or a slow decline rate (see Section 6).

At Risk

Taxa that do not meet the criteria for Acutely Threatened or Chronically Threatened, but have either restricted ranges or small scattered sub-populations, are listed in one of two categories (Range Restricted and Sparse) that fall under the

division ‘At Risk’. Although these taxa are not currently in decline, their population characteristics mean a new threat could rapidly deplete their population(s). Range Restricted taxa either occur in a small geographic area (e.g. Three Kings Islands), are restricted to a particular habitat (e.g. geothermal areas), or require very specific substrates (e.g. ultramafic rock), and for colonial breeders, have fewer than 10 sub-populations. Taxa that have naturally restricted ranges and taxa that have become restricted as a result of human activities are both included in this category. This is because both would face the same risk of extinction in the face of a new threat. The two groups are differentiated by the use of a qualifier (see Section 4, next page).

Sparse taxa have very small, widely scattered populations, e.g. New Zealand spinach (*Tetragonia tetragonoides*). As with the Range Restricted category, taxa that are either naturally sparse or have become sparse as a result of human activities are included in this category.

NOT THREATENED

Taxa that are assessed and do not fit any of the Threatened categories are listed in the Not Threatened category.

From Molloy *et al.* 2002, pp. 19–21

7. Criteria for the Acutely Threatened and Chronically Threatened categories

As illustrated in Fig. 2, a taxon must meet specific criteria to be listed in one of the Acutely Threatened or Chronically Threatened categories. The criteria for each category are set out below. Definitions of terms are given in Appendix 1.

NATIONALLY CRITICAL

Very small population *or* a very high predicted decline

A taxon is Nationally Critical when available scientific evidence indicates that it meets any of the following three criteria:

1. The total population size is ≤ 250 mature individuals.
2. Human influences have resulted in ≤ 2 sub-populations *and either*:
   a. ≤ 200 mature individuals in the largest sub-population, *or*
   b. the total area of occupancy is ≤ 1 ha (0.01 km^2).
3. There is a predicted decline of ≥ 80% in the total population in the next 10 years due to existing threats.

NATIONALLY ENDANGERED

A: Small population *and* moderate to high recent or predicted decline

A taxon is Nationally Endangered when available scientific evidence indicates that it fits at least one Status criterion *and* one Trend criterion as follows:

Status criteria

1. The total population size is 250–1000 mature individuals.
2. There are ≤ 5 sub-populations *and either*:
   a. ≤ 300 mature individuals in the largest sub-population *or*
   b. the total area of occupancy is ≤ 10 ha (0.1 km^2).

Trend criteria

1. There has been a decline of ≥ 30% in the total population or habitat area in the last 100 years.
2. There is a predicted decline of ≥ 30% in the total population in the next 10 years due to existing threats.

B: Small to moderate population *and* high recent or predicted decline

A taxon is Nationally Endangered when available scientific evidence indicates that it fits at least one Status criterion *and* one Trend criterion:

Status criteria

1. The total population size is 1000–5000 mature individuals.
2. There are ≤ 15 sub-populations *and either*:
   a. 300–500 mature individuals in the largest sub-population *or*
   b. the total area of occupancy is 10–100 ha (0.1–1 km^2).

Trend criteria

1. There has been a decline of ≥ 60% in the total population or habitat area in the last 100 years.
2. There is a predicted decline of ≥ 60% in the total population in the next 10 years due to existing threats.

NATIONALLY VULNERABLE

Small to moderate population *and* moderate recent or predicted decline

A taxon is Nationally Vulnerable when scientific evidence indicates that it fits at least one Status criterion *and* one Trend criterion:

Status criteria

1. The total population size is 1000–5000 mature individuals.
2. There are ≤ 15 sub-populations *and either*:
   a. 300–500 mature individuals in the largest sub-population *or*
   b. the total area of occupancy is 10–100 ha (0.1–1 km^2).

Trend criteria

1. There has been a decline of 30–60% in the total population or habitat area in the last 100 years *and the total population or habitat area is still in decline.*
2. There is a predicted decline of 30–60% in the total population in the next 10 years due to existing threats.

SERIOUS DECLINE

A. Moderate to large population *and* moderate to large predicted decline

A taxon is listed in Serious Decline when scientific evidence indicates that it fits at least one Status criterion *and* the Trend criterion:

Status criteria

1. The total population size is > 5000 mature individuals.

2. There are > 15 sub-populations *and either*:
   a. > 500 mature individuals in the largest sub-population, *or*
   b. the total area of occupancy is >100 ha (1 km^2).

Trend criterion

1. There is a predicted decline of > 30% in the total population in the next 10 years due to existing threats.

B. Small to moderate population *and* small to moderate predicted decline

A taxon is listed in Serious Decline when available scientific evidence indicates that it fits at least one Status criterion *and* the Trend criterion:

Status criteria

1. The total population size is < 5000 mature individuals.

2. There are ≤ 15 sub-populations *and either*:
   a. ≤ 500 mature individuals in the largest sub-population, *or*
   b. the total area of occupancy is ≤ 100 ha (1 km^2).

Trend criterion

1. There is a predicted decline of 5–30% in the total population in the next 10 years due to existing threats.

GRADUAL DECLINE

Moderate to large population *and* small to moderate decline

A taxon is listed in Gradual Decline when available scientific evidence indicates that it fits at least one Status criterion *and* the Trend criterion:

Status criteria

1. The total population size is > 5000 mature individuals.

2. There are > 15 sub-populations *and either*:
   a. > 500 mature individuals in the largest sub-population, *or*
   b. the total area of occupancy is > 100 ha (1 km^2).

Trend criterion

1. There is a predicted decline of 5–30% in the total population in the next 10 years due to existing threats, and the *decline is predicted to continue beyond 10 years*.

Appendix 10

Vegetation and habitats of Te Teko Ecological District

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Glossary of common names

African boxthorn	*Lycium ferocissimum*
akeake	*Dodonaea viscosa*
arrow grass	*Triglochin striata*
aute taranga	*Pimelea villosa*
bachelor's button	*Cotula coronopifolia*
banana palm	*Musa ×paradisiaca*
barberry	*Berberis glaucocarpa*
beggars' tick	*Bidens frondosa*
black nightshade	*Solanum nigrum*
black wattle	*Acacia mearnsii*
blackberry	*Rubus fruticosus* agg.
bracken	rarahu; *Pteridium esculentum*
brome	*Bromus* sp.
Californian thistle	*Cirsium arvense*
canna lily	*Canna indica*
catsear	*Hypochoeris radicata*
cleavers	*Galium aparine*
clustered dock	*Rumex conglomeratus*
cocksfoot	*Dactylis glomerata*
cotoneaster	*Cotoneaster glaucophyllus*
crack willow	*Salix fragilis*
creeping buttercup	*Ranunculus repens*
duckweed	*Lemna minor*
forget-me-not	*Myosotis* sp.
giant spike sedge	*Eleocharis sphacelata*
gorse	*Ulex europaeus*
grey willow	*Salix cinerea*
hangehange	*Geniostoma ligustrifolium* var. *ligustrifolium*
harakeke	flax; *Phormium tenax*
harestail	*Lagurus ovatus*
hawthorn	*Crataegus monogyna*
hornwort	*Ceratophyllum demersum*
Indian doab	*Cynodon dactylis*
inkweed	*Phytolacca octandra*
Japanese honeysuckle	*Lonicera japonica*
kahikatea	*Dacrycarpus dacrydioides*
kānuka	*Kunzea ericoides* var. *ericoides*
kāpūngāwhā	*Schoenoplectus tabernaemontani*
karamū	*Coprosma robusta*
kauri	*Agathis australis*
kawakawa	*Macropiper excelsum* var. *excelsum*
kikuyu	*Pennisetum clandestinum*
koromiko	*Hebe stricta* var. *stricta*
maawhai	*Sicyos* aff. *australis* (a); *Sicyos* aff. *australis* (b)
māhoe	*Melicytus ramiflorus* subsp. *ramiflorus*

mamaku	*Cyathea medullaris*
mānuka	*Leptospermum scoparium* agg.
māpou	*Myrsine australis*
marram	*Ammophila arenaria*
marsh ribbonwood	*Plagianthus divaricatus*
matai	*Prumnopitys taxifolia*
meadow rice grass	*Microlaena stipoides*
Mercer grass	*Paspalum distichum*
mingimingi	*Leucopogon fasciculatus*
montbretia	*Crocosmia ×crocosmiiflora*
NZ spinach	*Tetragonia tetragonioides*
oioi	*Apodasmia similis*
pampas	*Cortaderia selloana*
parrot's feather	*Myriophyllum aquaticum*
periwinkle	*Vinca major*
pīngao	*Desmoschoenus spiralis*
Ponderosa pine	*Pinus ponderosa*
porokaiwhiri	*Hedycarya arborea*
prickly mingimingi	*Leptecophylla juniperina*
privet	*Ligustrum sinense*
pukatea	*Laurelia novae-zelandiae*
puriri	*Vitex lucens*
radiata pine	*Pinus radiata*
ratstail	*Sporobolus africanus*
raupō	*Typha orientalis*
reed sweetgrass	*Glyceria maxima*
rewarewa	*Knightia excelsa*
rimu	*Dacrydium cupressinum*
ryegrass	*Lolium perenne*
sand tussock	hinarepe ; *Austrofestuca littoralis*
Scotch thistle	*Cirsium vulgare*
sea rush	*Juncus kraussi* var. *australiensis*
Spanish heath	*Erica lusitanica*
spearwort	*Ranunculus flammula*
spike sedge	*Eleocharis acuta*
spinifex	*Spinifex sericeus*
swamp coprosma	*Coprosma tenuicaulis*
swamp kiokio	*Blechnum minus*
swamp millet	*Isachne globosa*
sweet briar	*Rosa rubiginosa*
tall fescue	*Schedonorus arundinaceus*
tauhinu	*Ozothamnus leptophyllus*
tawa	*Beilschmiedia tawa*
Thornton kānuka	*Kunzea* aff. *erioides* (d)
tī ngahere	*Cordyline banksii*
ti kouka	cabbage tree; *Cordyline australis*
tītoki	*Alectryon excelsus*
toetoe	*Cortaderia fulvida* and *C. toetoe*
tōtara	*Podocarpus tōtara*
tradescantia	*Tradescantia fluminensis*
turepo	*Streblus heterophyllus*
tutu	*Coriaria arborea*
water lilies	*Nymphaea* sp.

water purslane	*Ludwigia palustris*
weeping willow	*Salix babylonica*
whauwhaupaku	fivefinger; *Pseudopanax arboreus* var. *arboreus*
whekī	*Dicksonia squarrosa*
wild ginger	*Hedychium gardnerianum*
willow weed	*Polygonum persicaria*
wire rush	*Empodisma minus*
yarrow	*Achillea millefolium*
Yorkshire fog	*Holcus lanatus*
Yunnan poplar	*Populus yunnanensis*

Glossary of technical terms

Alluvial Flat: Refer to Landform.

Alluvial Plain: Refer to Landform.

Bioclimatic Zone: One of the categories used in classifying natural climate and related biota. It refers to the broad distribution of vegetational zones along altitudinal gradients where a particular climatic regime dictates the character of the natural ecosystem.

Two bioclimatic zones are recognised within the Te Teko Ecological District. Refer to text.

Buffer: A zone surrounding a natural area which reduces the effect of external influences upon the features within the natural area, e.g., vegetation such as modified forest/scrub or a stream.

Buffering: Refer to Recommended Area for Protection Selection Criteria.

Canopy: The layer or layers formed by the uppermost crown or their parts. The concept is applicable to any kind of vegetation. In forests it includes lianes and epiphytes.

Coastal Zone: Refer to Bioclimatic Zone.

Communities: A collection of populations of animals and plants that occur naturally together in a common environment of any size.

Conservation Value: The relative merit of a natural feature within a regional or national context (say within an ecological region or ecological district).

Diversity: The range of the natural physical and biotic components in the landscape including species, communities, ecosystems, landforms, soil sequences, and dynamic systems and processes.

Dune Hollow: Depression or low area between dunes, may have groundwater at surface.

Ecological Character: The distinguishing features of a particular place, definable in terms of biotic composition, climatic, edaphic and topographical factors.

Ecological Class: A category which describes the broad ecological patterns within an ecological district in terms of bioclimatic zone, hydrological class, vegetation structural class, and land system, e.g., a coastal palustrine reedland on uplifted marine terrace.

Ecological District: A local part of New Zealand where geological, topographical, climatic and biological features and processes, including the broad cultural pattern, interrelate to produce a characteristic landscape and range of biological communities. New Zealand has been subdivided into 268 such districts, setting the level for assessing the representativeness of major ecosystem types.

Ecological Region: A group of adjacent ecological districts with closely related ecological characteristics, or, in some cases, a single very distinctive ecological district. New Zealand has been subdivided into 85 such regions.

Ecological Unit: Any combination of vegetation types (or suite of interrelated types), plus the landform it occurs on, e.g., kahikatea forest on flood plains, narrow-leaved snow tussock—hard tussock tussockland on gravel terraces. Other important attributes of the unit such as the bioclimatic zone (e.g., montane, coastal) may be added to the name.

The concept of ecological units has been designed to give specific meaning to the Reserves Act 1977 phrase "all classes of natural ecosystems ...". Ecological units are used in the survey phase to determine the biological and physical composition of the study areas.

Endangered: Refer to rarity.

Endemic: Occurring naturally in, and restricted to, a particular country, region or locality. Refer to Indigenous.

Estuarine: Refer to Hydrological Class.

Exotic: Introduced from abroad.

Fernland: Refer to Vegetation Structural Class.

Foredune: Refer to Landform.

Forest: Refer to Vegetation Structural Class.

Grass/Sedge/Rushland: Refer to Vegetation Structural Class.

Habitat: The part of the environment in which a plant or animal lives. An organism usually has adaptations which allow it to live in that particular part of the environment, and it may be more or less restricted to that habitat.

Herbfield: Refer to Vegetation Structural Class.

Hillslope: Refer to Landform.

Hydrologic Class: One of six descriptive categories used in classifying the influence of water on the character of the biotic elements. If water is not a significant influence, a site is considered terrestrial. On sites where water is a major feature the characteristics of the soils and biota will be strongly influenced by the nature of the water body (e.g., palustrine, lacustrine, estuarine) and its nutrient content.

Estuarine Tidal and non-tidal saline wetlands associated with a coastal body of water with a free connection to the open sea, and where freshwater derived from land drainage (usually rivers) is mixed with sea water.

Terrestrial Free water has an insignificnat role in the ecological character of these areas.

Palustrine A wetland community/environment characterised by emergent vegetation which may, or may not, have free standing water present.

Lacustrine A lake community/environment lacking persistent emergent vegetation.

Riverine A system of flowing freshwater.

Indigenous: Indigenous to, occurring naturally in, characteristic of, a particular country, region or locality. All the indigenous features of New Zealand give it its own distinctive character.

Induced: Indigenous vegetation established after destruction or disturbance of the previous cover, and which may dominate for many decades, but is essentially different from the original vegetation, e.g., rarahu fernland, mānuka scrub.

Lacustrine: See Hydrologic Class.

Landform: All the physical, recognisable, naturally formed features of land, having a characteristic shape, e.g., hill, valley or alluvial fan. In the PNA Programme, classification of a landform emphasises its ecological significance rather than its geomorphological or geological significance.
Landform Definitions (after Soons and Selby (1982), Bayfield and Benson (1985) and interpretation by the authors):

Alluvial Flat or Plain Flat area associated with river, over which the river course is unconfined (or was unconfined prior to construction of stopbanks).

Alluvial Terrace Flat to gently sloping area of alluvium of variable height above river level. May be periodically flooded.

Dune Hollow Low concave area or depression between dunes, may have groundwater at surface.

Flat Flat land.

Fore Dune A coastal dune parallel to the shoreline at the landward margin of the beach.

Hillslope Slope unit on which drainage lines are predominantly parallel.

Rear Dune A coastal dune parallel to the shoreline landward of the foredune.

Ridge The top (often acute angled) of a divide between two drainage ways.

Wetland Poorly-drained area where the water table is near, or at, or above the ground surface on a regular or permanent basis.

Local: Refer to rarity.

Native: Not known to have been introduced by human agency.

Natural Area: A place characterised by indigenous species or ecosystems, or a place or landform not or scarcely modified from an indigenous condition.

Some natural areas will be identified as suitable for evaluation of ecological quality and representativeness, and hence also be study areas. Some of these may be of sufficient quality to become Recommended Areas for Protection. In some instances one natural area may embrace more than one study area.

or: A tract of land which supports vegetation and landforms considered to be in a predominantly natural state; identified as a suitable unit for evaluation of ecological quality and representativeness and has potential to be recommended for protection.

Natural Diversity: Refer to Recommended Area for Protection Selection Criteria.

Naturalised: Arriving from outside; in contrast to indigenous.

Naturalness: Degree to which ecological units/communities/ecosystems retain their original character. Refer to Original Natural Ecosystem.

Also refer to Recommended Area for Protection Selection Criteria.

Nature Conservation Value: A relative value assessment for nature conservation purposes based on scientific criteria derived from ecological, and biogeographical theory (diversity, naturalness, rarity etc) and on the social value placed on those criteria.

Original Natural Ecosystem: Original natural landscape—the original state of an ecosystem and the landscape is that which prevailed before the arrival of humans in New Zealand with their domesticated and commensal animals and plants. A major objective of most nature conservation strategies in New Zealand is to protect indigenous ecosystems and landscapes that most closely approximate this state. In Te Teko Ecological District, it applies to areas where the landscape has remained in, returned to, or is returning to its probable original state (i.e. mature or steady-state forest) of the pre-Polynesian period.

Palustrine: See Hydrologic Class.

Pattern: Refer to Recommended Area for Protection Selection Criteria.

Primary: Indigenous vegetation which has never been logged or cleared in any part.

Protected Natural Area (PNA): A legally protected area, characterised by indigenous species or ecosystems, in which the principal purpose of management is retention of the indigenous state.

Rare: Refer to Recommended Area for Protection Selection Criteria.

Rarity: Refer to Recommended Area for Protection Selection Criteria.

Rear Dune: Refer to Landform.

Recommended Area for Protection (RAP): An area identified as a high priority for protection because it contains the best example or good examples of its type or class of natural ecosystem and/or landscape in an ecological district. More than one area may require identification in certain circumstances.

A RAP is intended to be the basis for a proposal for a new protected natural area that would supplement the existing system of protected natural areas to make it more fully representative of New Zealand's ecological diversity.

Recommended Area for Protection Selection Criteria: Seven selection criteria are used for identifying Recommended Areas for Protection in the PNA Programme: representativeness, diversity and pattern, rarity and special features, naturalness, size and shape, buffering and connectivity, and ecological viability.

Representativeness The primary criterion, based on a comparison of present vegetation cover vs past extent, diversity and pattern, naturalness, and size.

Diversity and pattern The diversity of ecological and physical features, and the patterns that exist within an area under consideration.

Naturalness The degree to which the vegetation and habitats reflect likely natural character. Most mainland ecosystems are modified but the degree of naturalness is an important consideration.

Size and shape Areas which are relatively large (i.e. compared to the mean size of remaining areas of indigenous vegetation in an Ecological District) are preferred to small areas. Small areas can be affected strongly by edge effects. A compact single area is generally preferable to long narrow areas or small separate remnants.

Rarity and special features The relative rarity of physical landscape features, vegetation, habitats and species within an ecological region or district or on a national basis (see Hitchmough *et al.* 2007, de Lange *et al.* 2009, Miskelly *et al.* 2008).

Buffering and connectivity The degree to which a natural area is protected or buffered by the surrounding landscape, or provides a buffer to other areas. A site may play an important role by connecting other areas of indigenous vegetation or habitat, or providing a riparian buffer.

Viability The likelihood of an area remaining ecologically viable over time. Larger areas are generally more likely to remain viable with lower levels of management input.

Reedland: Refer to Vegetation Structural Class.

Representative: Refer to Recommended Area for Protection Selection Criteria.

Ridge: Refer to Landform.

Riverine: Refer to Hydrologic Class.

Sand dune: Refer to Landform (foredune, rear dune, dune hollow).

Sandfield: Refer to Vegetation Structural Class.

Scrub: Refer to Vegetation Structural Class.

Secondary: Secondary indigenous vegetation, seral regrowth after destruction or disturbance.

Semi-coastal Zone: Refer to Bioclimatic Zone.

Site: Refer to Recommended Area for Protection Selection Criteria.

Size and Shape: Refer to Recommended Area for Protection Selection Criteria.

Shrubland: Refer to Vegetation Structural Class.

Study Area: A tract of land with indigenous vegetation delineated as suitable for survey in rapid field inventory in order to identify the ecological patterns and the natural diversity of an ecological district.

It is an arbitrary unit, defined appropriate to circumstances—it may be defined by the boundary of a remnant forest stand; a catchment; a legal title; or in largely undifferentiated environments by grid squares or other manageable, arbitrarily bound areas.

Succession: The process of change in the appearance, composition and structure of a community, usually over a number of years. Change may be due to biotic factors, or site factors, or both.

Surrounding Landscape: Refer to Recommended Area for Protection Selection Criteria.

Tephra: A collective term for all the unconsolidated, primary pyroclastic products of a volcanic eruption, including both pyroclastic flow and airfall deposits.

Terrestrial: See Hydrologic Class.

Threatened Species: Refer to Appendix 9 for categories of threats.

Treefernland: Refer to Vegetation Structural Class.

Treeland: Refer to Vegetation Structural Class.

Tussockland: Refer to Vegetation Structural Class.

Vegetation Structural Class: Vegetation classification based on the type of plant which is dominant in the canopy, e.g., forest, reedland. These are based on Atkinson (1985), with the following abbreviated definitions:

Forest—more than 80 percent trees in the canopy.

Treeland—less than or equal to 80 percent trees in the canopy.

Scrub—more than 80 percent shrubs in the canopy.

Shrubland—less than or equal to 80 percent shrubs in the canopy.

Tussockland—herbaceous plants, including grasses, land sedges and rushes, with leaves densely bunched at the base. This includes flax and toetoe.

Grass/Sedge/Rushland—herbaceous monocotyledons with narrow linear leaves not densely bunched at the base.

Reedland—tall herbaceous monocotyledons with linear leaves containing spongy mesophyll tissue.

Fernland—dominated by ferns.

Sandfield—bare sand exceeds the area covered by any one class of plant growth form.

Treefernland—dominated by treeferns.

Vineland—dominated by vines.

Herbfield—dominated by small herbaceous plants not included in the above categories.

Vegetation Type: A term which includes the dominant canopy species and structural class of an area of vegetation, e.g., rimu/tawa-kāmahi forest, *Ficinia nodosa/ Muehlenbeckia complexa* sedge-vineland.

In addition, cover values and tiers are included, i.e.:

(tawa) less than 5 percent cover of the bracketed species.

(rimu)/tawa indicates less than 5 percent cover of rimu emergent over a canopy of tawa.

tawa-hinau indicates tawa and hinau occur in the same tier.

⇔ mosaic.

Viability: Refer to Recommended Area for Protection Selection Criteria.

Vineland: Refer to Vegetation Structural Class.

Vulnerable: See Rarity in Recommended Area for Protection Selection Criteria.

\+ Small amount (e.g., less than 0.5%).

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